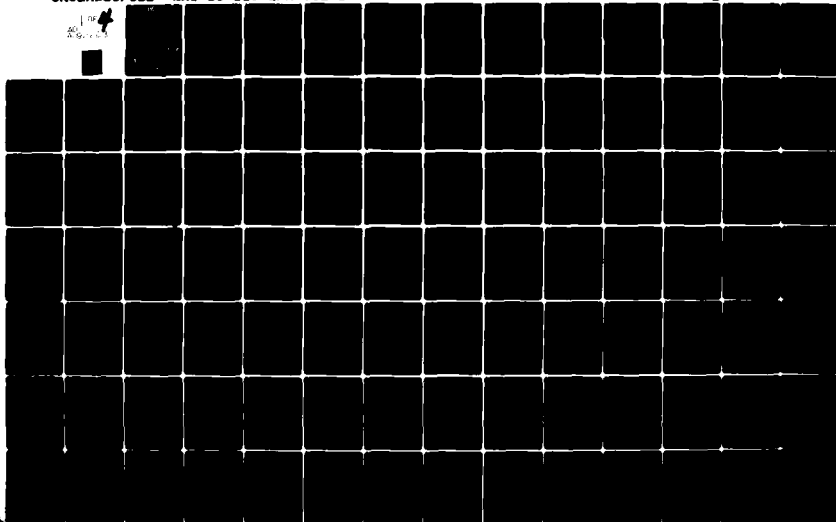


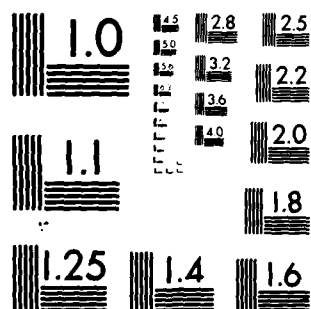
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AN ASSESSMENT OF THE HYPOTHETICAL IMPACT
OF DRUG ABUSE ON COMBAT CAPABILITY

VOLUME I - FINAL REPORT

B. Tullington
H. Strickland
R. Griner

December 1979

Supported by:

U.S. Army Medical Research and Development Command
Fort Detrick, Frederick, Maryland 21701

Contract No. DAMD 17-79-C-9107

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DEPARTMENT OF THE ARMY
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WASHINGTON, D.C. 20012

REPLY TO
ATTENTION OF: SGRD-UWI

16 July 1980

To the Reader:

Recently, the US Army Medical Research and Development Command was tasked to characterize the impact of individual performance degradation on unit combat readiness. This report is the product of a research effort directed at satisfying this research requirement.

Drug use by our service members is a complex multi-dimensional phenomenon. It is common to hear of, and read about, the drug problem in the military. Unfortunately, seldom is there agreement as to the nature of this problem. This lack of consensus stems from the fact that drug use and abuse pose multiple problems for our armed forces. Depending on one's perspective and responsibilities, the drug problem may be one related to health, performance, control, prevention, morality, discipline, or a number of other vital issues. The current tasking focused attention on still another demension of the problem. Namely, how well combat units could perform their essential missions if the performance of individual unit members had been degraded in some way by the use of drugs?

The tasking presented an extraordinary challenge. Drug use by our service members is almost always intermittent. Different drugs are used at different times, in varying combinations with one another and in varying doses. The effects of drugs on performance vary with time since administration. Performance demands themselves vary from military job to military job, from unit to unit and across operational settings. In combat the effective military unit makes demands on all human physical and mental faculties as well as the full range of sensory and motor skills. The task of arraying individually abused drugs and combinations of abused drugs, in varying amounts and at different times since administration, against all of the performances and skills required for effective unit performance is beyond the scope of any scientific undertaking. Even if it were possible to complete such a matrix, the essential question of whether a given military unit could perform its essential functions would remain unanswered for options exist for commanders to substitute personnel and augment essential teams as circumstances warrant.

16 July 1980

For the reasons stated above, an alternative strategy was selected. Science Applications Incorporated, (SAI) was asked to utilize its AMORE methodology to examine how the loss of certain skills and performances would limit the capacity of different types of military units to perform their essential missions. Because both civilian and military scientists have demonstrated that the population at risk, or most likely to be involved in drug use, is under age 25, SAI was asked to determine which jobs in a number of military units are likely to be occupied by soldiers under age 25. These jobs represented the pool of skills and performances available to the unit from its under 25 population. Because drug use tends to be limited to this age group, this pool of skills and performances is also that most likely to suffer degradation from drug use.

Because it is impossible to specify how much degradation would occur in any individual, SAI was told to assume that drug use reduced an individual's utility to zero. That is, that the individual could contribute none of the performances and skills associated with his military job. It was recognized from the outset that this represented an extreme case, but it was nonetheless one way of characterizing the resiliency of our current tables of organization and equipment (TOE's) in the face of the loss of certain skills and performances. For successive computer runs SAI was directed to eliminate from availability, first ten, then twenty, thirty and forty percent of the military jobs occupied by soldiers under age 25, and then to determine the capacity of the unit to carry out its essential functions. SAI was instructed to then inflict further damage of the kind to be anticipated in combat to both the unit's personnel and equipment and again to determine the impact on the unit's capacity to perform its essential missions.

This report arrays the results of the research effort described above. It describes how losses of skills and performances of individuals most likely to be involved with drugs would reduce the capacity of units to perform their essential functions. Furthermore, it indicates rather clearly that TOEs differ in the degree to which drug use might limit their combat capability. The threat of functional failure due to drug use appears greatest in those units where younger soldiers perform critical functions and commanders have few options with respect to substitutability of personnel.

The AMORE methodology assesses the capacity of units to perform critical functions by attempting to rebuild mission essential teams out of the skills and performances available to the commander following personnel losses. When a team cannot be

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16 July 1980

built, the AMORE system identifies the reason, typically the lack of a suitably trained individual that can substitute for a specific personnel loss. For this reason, the report also contains listings by MOS of critical personnel whose loss, whether due to drug abuse or combat damage, deprives the commander of the resources to reconstitute essential teams. The commander concerned with possible shortfalls in performance by identified individuals afflicted with serious drug or alcohol problems can view these critical skill lists as a basis for assessing the impact functional failure of these individuals might have on unit capability and can make judgements as to the merits of cross-training other personnel to minimize my potential adverse impact.



FRANK J. SODETZ
LTC, MSC

Contracting Officers Technical
Representative

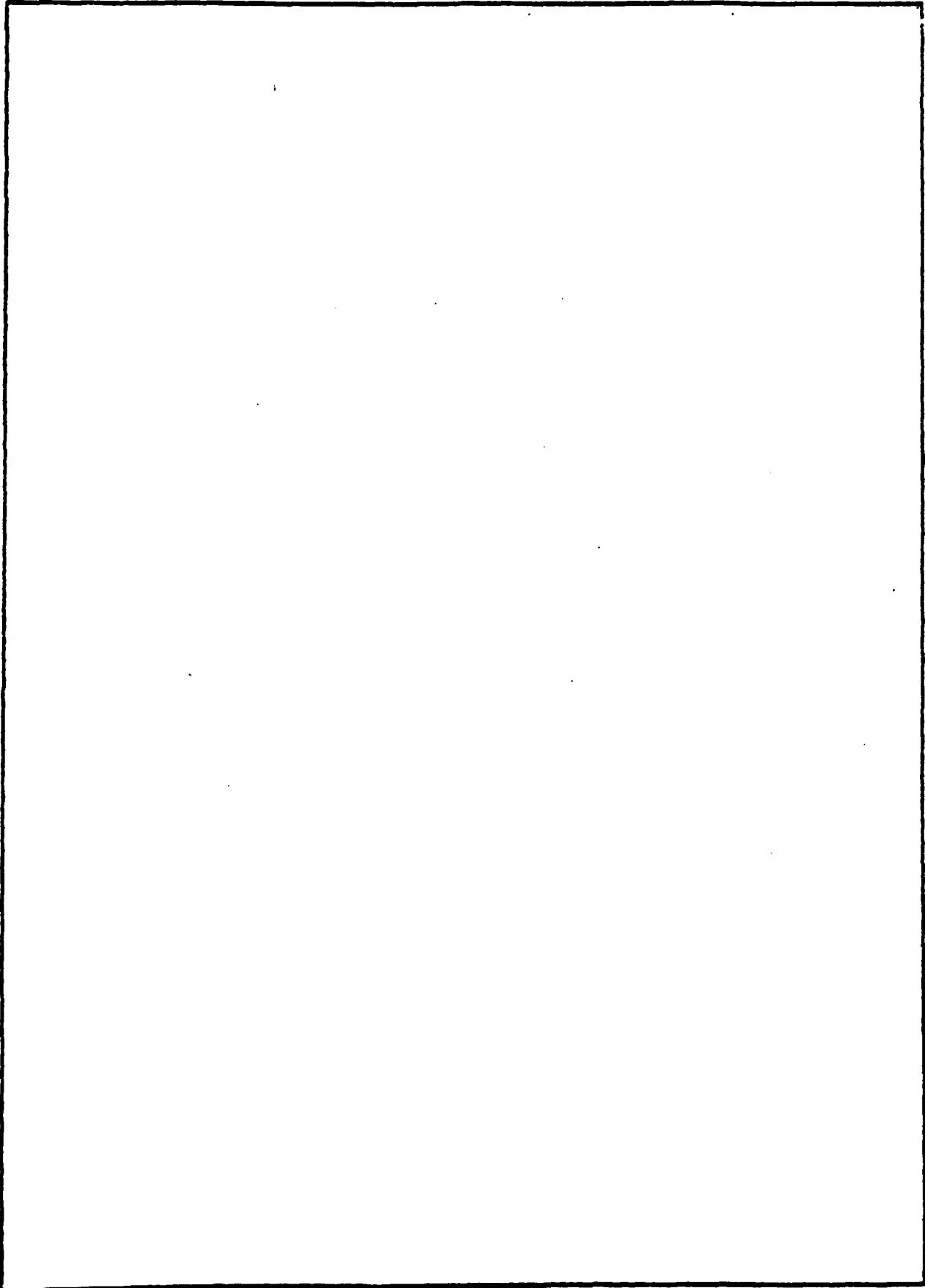
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Armor, artillery & infantry company-size unit organizations are analyzed to examine potential unit effectiveness before and after combat damage, assuming personnel incapacitation from hypothetical drug abuse distributions of 10%, 20%, 30%, & 40% among those personnel less than 25 years of age. The relative risk to loss of unit effectiveness from drug abuse is quantified & personnel functions key to unit mission accomplishment are identified before & after combat damage. Additionally, equipment critical to unit effectiveness is identified & its impact on unit capability discussed. Artillery units, particularly Headquarter Battery, are at greater risk to functional failure from drug abuse than are armor or infantry units.		

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PREFACE

This study was conducted in response to a request by the Walter Reed Army Institute of Research to assist the Army in defining the functional impact of hypothetical distributions of drug abuse on armor, artillery, and infantry company-size units. It is important to note that no degradation of performance due to the actual abuse of a particular drug or drugs is specified or examined. That important analysis is left for a later effort.

A unit's ability to perform a specific mission was evaluated by quantifying the number of essential teams of personnel and equipment the unit could form under various situations. Here essential teams are those combinations of personnel functions and items of equipment required to perform a particular task in order for the unit to accomplish its mission. Each of the nine combat units was examined under various combinations of assumed combat damage and additional personnel losses from hypothetical drug-abuse distributions. Individual probabilities of being a casualty were determined as a function of age (from data provided by US Army MILPERCEN), hypothetical percentages of drug abusers in each unit, and various levels of combat casualties. Drug abuse was considered incapacitating in order to demonstrate the maximum potential loss of unit effectiveness in each of these units. The resulting measure of unit effectiveness provides a powerful analytic tool for comparing the combat risk (as measured by unit effectiveness) among these units to functional failure from drug abuse. Additionally, identification of personnel functions found critical to unit effectiveness provides a basis for considering personnel policies regarding drug abuse or other age-dependent phenomena.

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CHAPTER ONE SUMMARY

SECTION I INTRODUCTION

1. PURPOSE

The purpose of this research was to assist the U.S. Army in defining the potential functional impact of hypothetical distributions of drug abuse on company-size armor, artillery, and infantry units by examining the following questions:

- How is initial combat capability affected by drug users in these units?
- Which skills become critical to unit recoverability (after combat attrition) due to troop losses attributable to drug abuse?
- What critical positions become likely candidates for intensive management and surveillance in a drug-abuse environment?
- What further surveys and research will prove fruitful in controlling the impact of drug abuse on combat capability?

2. BACKGROUND

Tests of troop units in Europe (which are some of the most elite in the Army) reportedly have shown drug-abuse levels as high as 4.2 percent for the more powerful drugs such as heroin, barbiturates, or amphetamines and upwards of fifty percent for the less potent marijuana and hashish. Of great concern is what this widespread drug abuse may do to soldiers who are supposed to be ready to use highly sophisticated weapons and equipment on short notice. While the social consequences of drug abuse on unit integrity, cohesion and morale are fairly well understood and appreciated, little is known about the potential effects of this behavior on unit effectiveness in combat.

As an initial step in better understanding the problem, this study examines the potential impact on unit effectiveness from a worst case point of view, using hypothetical drug-abuse data. No degradation of performance due to actual abuse of a particular drug or drugs is specified or examined. Because the greatest potential impact (risk) on unit effectiveness can be expected when drug abuse results in total functional incapacitation, combat unit organizations are analyzed from that perspective. Further, quantification of the unit effectiveness following losses from drug abuse provides a means of comparing unit risk to potential critical functional failure.

3. THE APPROACH

A unique SAI methodology entitled "The Analysis of Military Organizational Effectiveness (AMORE)" was used to examine the capability of each unit to perform a specific mission and to identify those personnel functions and equipment critical to unit recovery after losses from combat and drug abuse.

Briefly, application of this methodology to each unit examined proceeds through the steps outlined below. A more detailed discussion of the logic and implications of this procedure is found in Chapter 2, Methodology.

• Input Data Preparation

Mission Selection The mission is key to the analysis. The measure of the unit's effectiveness is determined by how well the unit can form teams of personnel and equipment to do those tasks essential to mission accomplishment. For this study, each unit was given a similar mission: conduct those basic combat functions required for defensive operations in an armor-heavy environment for a short period of time (twenty-four hours).

TOE Analysis Each unit's organization is examined to identify those functions essential to mission accomplishment and further to identify the minimum equipment and personnel tasks (by MOS) required to perform those functions.

Team Preparation The personnel functions and equipment are then organized into teams. Each team consists of the smallest group functionally capable of adding an equal increment of effectiveness contributing to accomplishment of the unit's mission.

Essential Personnel Those personnel functions necessary for mission accomplishment are identified as essential.

Transferability/Substitutability Personnel functions and equipment are further examined to determine the extent one function may substitute for another. A cost in time is calculated or estimated and then assigned to these permissible transfers.

Casualty/Damage Probabilities Susceptibility to drug abuse is assumed equal to the probability that an MOS is occupied by an individual less than twenty-five years of age. This probability multiplied by a given level of drug abuse in a unit determines the probability that the MOS is non-functional from drug abuse. Losses from combat are also levied to determine the unit's ability to perform its mission after sustaining losses of both personnel and equipment.

- Computer Operations

Using the input generated above, a computer simulation stochastically assesses casualties to personnel and damage to equipment. It then reconstitutes the unit to its maximum remaining capability in the shortest period of time.

This process is repeated for all combinations of combat damage and drug-abuse levels of interest. Additionally, the model identifies those personnel and materiel shortages that prevent the unit from forming additional teams.

• Analysis

The output of the simulation at different levels of damage is analyzed to determine the cause of limited unit effectiveness and to assess the relative risk among units of functional failure due to drug abuse. Personnel skills are identified as to their relative criticality to unit reconstitution following combat losses. The impact of additional losses from drug abuse on those skills previously identified as critical is also assessed.

Unit Effectiveness Unit effectiveness is defined as the number of teams the unit can form at any given time as a percentage of the maximum number of possible teams. For example, a rifle company was divided into eighteen teams for analysis purposes (each team built around the fire team of the rifle squad). If, due to losses, the unit could form only nine teams, the unit would be reported as fifty percent effective. The availability of both equipment and personnel are considered in evaluating unit effectiveness. The changes in unit effectiveness following losses from drug abuse are measures of each unit's relative risk to failure from drug abuse.

To quantify this relative risk to functional failure from drug abuse at the various damage cases a convenient ratio was developed. This ratio represents a unit's tolerance to increased drug abuse and is the measure of the ability of an organization to sustain its effectiveness in a drug-abuse environment. It is defined as the ratio of percent of personnel effectiveness lost to the increased percent of drug abuse. A higher ratio indicates a greater relative risk to drug abuse. For example, a unit that experienced a loss of twenty percent in effectiveness when the incidence of drug abuse increased by forty percent would have a tolerance ratio of .50 (20/40). Another unit may lose thirty percent in effectiveness for an increase in drug abuse of ten percent. That unit's tolerance ratio would be 3.00.

Critical Personnel The AMORE model determines which personnel functions cannot be filled during each iteration and records the average shortages for all runs. These shortages are analyzed to determine which functions cause the model to "choke" as it tries to build the maximum number of teams. For example, the rifle company may have been capable of forming only nine teams because of a shortage of squad leaders. The model would indicate that ten teams could not be built from the survivors, with a squad leader function causing this choke at team ten. The average number of times this skill is short would also be shown. The squad leader function is now considered critical to the unit's ability to reconstitute mission capability. By sampling the unit at several damage levels, the number of times a particular function causes the model to choke can be used to rank those essential functions in terms of criticality. The more frequently the model chokes on a particular function the more critical the function is to the unit.

Required Substitutes Required substitutes are those personnel functions not readily identifiable as essential for mission accomplishment, but required as substitutes for and required to perform the function of those positions defined above as critical. Thus, the executive officer's function may not be necessary for short periods of intense combat. However, in the commander's absence the executive officer may be required to assume command. This makes him more important to the unit than some other "nonessential" function that is not required to substitute for a critical function.

SECTION II

SUMMARY OF FINDINGS

The results of this study (discussed in detail in Chapters 3, 4 and 5) are presented here in summary form to facilitate rapid review of the major findings. In order to completely understand the importance of the interactions between mission, team construction, damage assessment, and other variables integral to this analysis, study of Chapter 2, Methodology, is suggested.

1. RISK TO LOSS OF UNIT COMBAT EFFECTIVENESS

Each of the nine company-size unit organizations was examined to determine the unit combat capability (effectiveness) remaining after suffering losses at several damage and drug-abuse levels. The measure of this effectiveness is the percentage of the number of teams the unit could reconstitute following degradation from assumed combat and drug-abuse losses. The difference in effectiveness for each of these units is the measure of the relative risk each faces at the assumed levels of combat and drug-abuse degradation. There is a significant difference in the risk of functional failure from drug abuse among the units examined. These results are shown graphically in Figure 1-1 (Armor Battalion), Figure 1-2 (Artillery Battalion), and Figure 1-3 (Infantry Battalion). Four damage cases are shown for each battalion and represent the levels of combat damage on the company-size units shown. Damage Case 0 shows the variation in unit effectiveness as a function of increasing levels of drug abuse with no accompanying combat casualties. Damage Cases 1, 2, and 3 show the variation in unit effectiveness as a function of increasing levels of drug abuse with accompanying combat casualties of 10%, 20%, and 30%, respectively. Thus, for example, the curves in Figure 1-3, Damage Case 2, show the decline in unit effectiveness of the three companies of the Infantry Battalion as the level of drug abuse increases for an assumed constant level of combat casualties, twenty percent.

In Figure 1-1 headquarters and headquarters company remains at one-hundred percent combat effectiveness at Damage Case 0 for all levels of drug abuse. Assuming Damage Case 3 (thirty percent personnel casualties) the unit effectiveness falls from eighty percent at zero drug abuse to approximately sixty percent, if forty percent of those susceptible to drug abuse are also rendered ineffective. In all instances the combat support company is less effective (at greater risk) than the other units in the armor battalion. Figure 1-3 shows a similar relationship between the headquarters company and combat

support company of the infantry battalion. The relatively small impact on effectiveness from even high levels of drug abuse on these two headquarters companies is a result of essential functions for its combat role (primarily command and control) being performed by more senior and older personnel. Conversely, tasks essential to the combat support companies (reconnaissance and fire support) of both battalions are carried out by younger personnel. The tank and rifle companies fall in between these two extremes.

The artillery battalion results (Figure 1-2) are quite different from the armor and infantry units. The headquarters battery capability to perform its combat mission is severely degraded by drug abuse, particularly at zero combat damage (Damage Case 0). At ten percent drug abuse, effectiveness falls to about seventy-five percent and continues to drop below fifty percent as the assumed level of drug abuse goes from ten percent to forty percent. This high risk to loss of effectiveness is due in large measure to two factors: (1) how the unit functions and (2) the age of personnel performing essential tasks. In addition to those command and control functions performed by all headquarters companies, the artillery headquarters battery performs certain fire-direction functions critical to mission accomplishment. These include fire-direction computation, battery, positioning, target acquisition, and air defense functions not found in other headquarters units. These tasks are also performed by relatively younger personnel. The service battery on the other hand has fewer tasks essential to the intense combat situation and more personnel available to perform these tasks. The firing battery is slightly more vulnerable to drug abuse than the service battery. At high casualty levels (Damage Case 3) the loss in effectiveness is more a result of a reduction in total survivors than failure of a particular function.

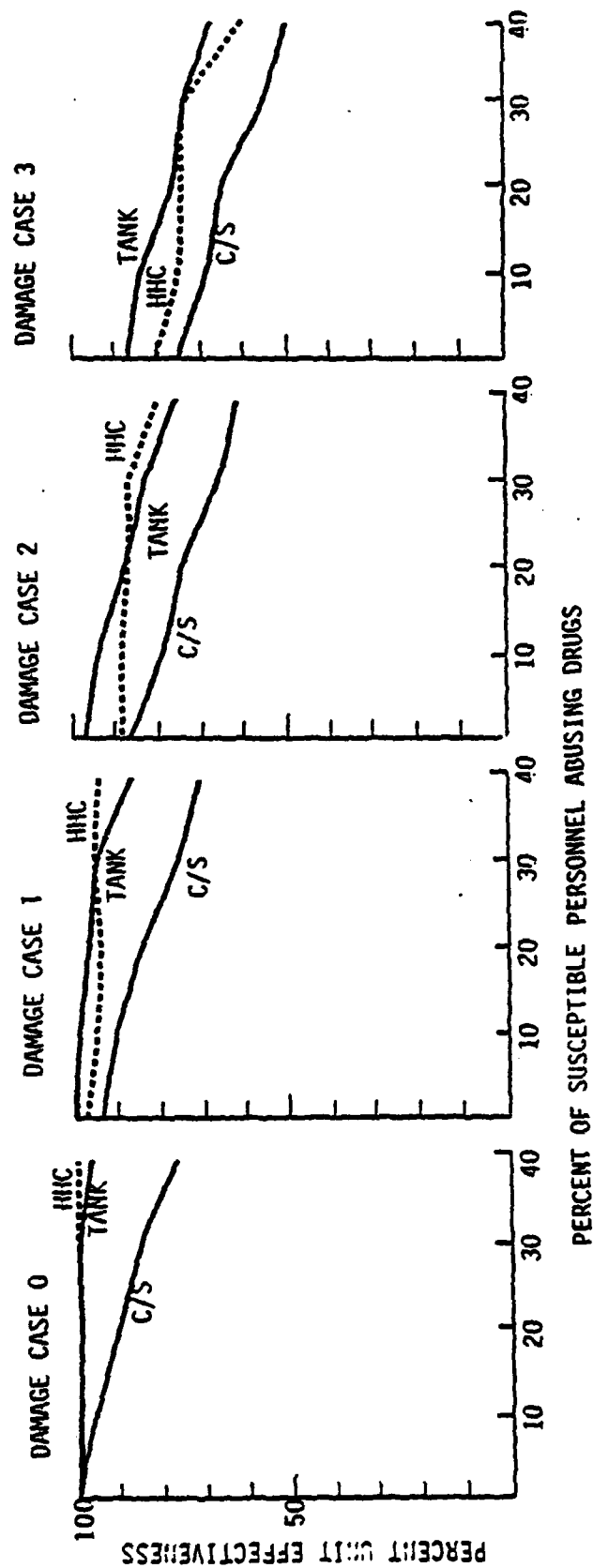
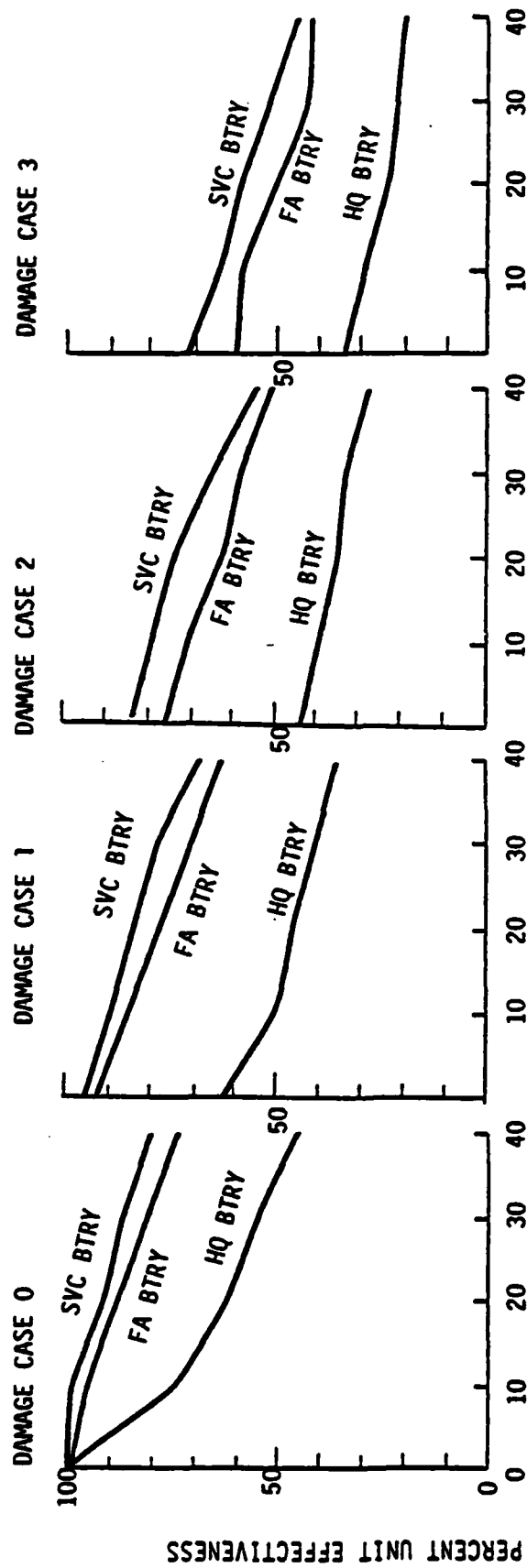
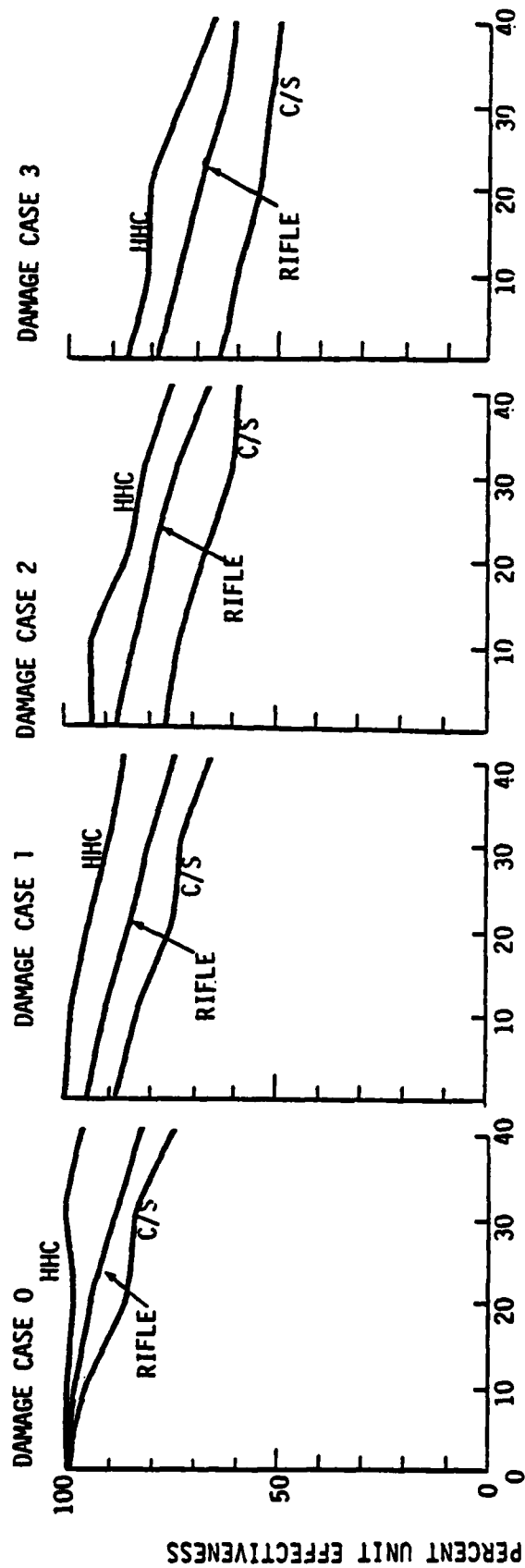


FIGURE 1-1. SUMMARY OF UNIT EFFECTIVENESS AT VARIOUS DRUG ABUSE LEVELS AND DAMAGE CASES, ARMORED BATTALION.



PERCENT OF SUSCEPTIBLE PERSONNEL ABUSING DRUGS

FIGURE 1-2. SUMMARY OF UNIT EFFECTIVENESS AT VARIOUS DRUG ABUSE LEVELS AND DAMAGE CASES. FIELD ARTILLERY BATTALION.



PERCENT OF SUSCEPTIBLE PERSONNEL ABUSING DRUGS

FIGURE 1-3. SUMMARY OF UNIT EFFECTIVENESS AT VARIOUS DRUG ABUSE LEVELS AND DAMAGE CASES, INFANTRY BATTALION (MECH).

The ability of an organization to sustain its effectiveness in a drug-abuse environment is defined as the ratio of percent of personnel effectiveness lost to percent of increase in drug abuse. A higher ratio indicates a greater relative risk due to drug abuse. For example, a unit that experienced a loss of twenty percent in effectiveness when the incidence of drug abuse increased by forty percent would have a tolerance ratio of .50 (20/40). Table 1-1 lists the tolerance ratios for the nine units examined, before and after combat damage. Each ratio was obtained through regression analysis of four drug-abuse levels (10%, 20% 30%, and 40%) for each combat damage case. The circled entries indicate the highest ratio (poorest tolerance) of the company-size units within the battalion for each combat damage case.

TABLE 1-1. TOLERANCE RATIOS

Effect of Drug Abuse At

UNITS	Damage Case 0	Damage Case 1	Damage Case 2	Damage Case 3
Armor Bn				
HHC	.00	.02	.02	.40
C/S Co	(.56)	(.76)	(.64)	(.64)
Tank Co	.06	.29	.55	.53
F. A. Bn				
HMB	(.30)	.59	.42	.38
Svc Btry	.52	.63	(.70)	(.66)
FA Btry	.68	(.71)	.64	.51
Inf. Bn				
HHC	.06	.35	.46	(.48)
C/A Co	(.63)	.36	(.48)	.35
Rifle Co.	.49	(.49)	.40	.44

Examination of the company units shows headquarters company of the armor battalion is relatively unaffected by drug abuse until the higher combat-damage levels are reached. It is also of interest that the rifle company's tolerance to drug abuse is relatively insensitive at any of the four levels of combat damage.

While Table 1-1 portrays each unit's ability to tolerate drug abuse, equipment shortages in several cases outweighed the impact of personnel casualties from both combat and drug abuse. The probability of combat damage to equipment was determined from Joint Munitions Effectiveness Manuals considering the collateral damage to major items of equipment that could be expected for each assumed personnel-casualty level. In these instances equipment, not personnel, limited unit effectiveness. Table 1-2 shows the key limiting factor (M = Materiel, P = Personnel) that precluded further restoration of combat capability for each combat-damage case and drug-abuse level considered. A review of Table 1-2 shows that the combined effects of combat damage and drug abuse result in a personnel-limited force for most of the units examined in this study. Both combat support companies and the service battery are personnel limited in every case. On the other hand, the tank company is most affected by materiel shortages except at the forty percent drug-abuse level for Damage Case 1 and the thirty percent and forty percent drug-abuse levels for Damage Case 2. Unit effectiveness of the tank company is never limited by personnel in Damage Case 3. The rifle company was limited by materiel at Damage Case 2, zero drug abuse, primarily from shortages to the TOW anti-tank weapon. (Recall that Damage Cases 0, 1, 2, and 3 correspond to 0, 10%, 20%, and 30% combat casualties, respectively.)

TABLE 1-2. SUMMARY OF LIMITING FACTORS

Damage Case	1					2					3				
Drug Level	0	.1	.2	.3	.4	0	.1	.2	.3	.4	0	.1	.2	.3	.4
Armor Battalion															
HHC	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
C/S Co	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Tank Co	M	M	M	M	P	M	M	M	P	P	M	M	M	M	M
F.A. Battalion															
HHB	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Svc Btry	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
FA Btry	M	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Inf. Battalion															
HHC	E	P	P	P	P	P	P	P	P	P	P	P	P	P	P
C/S Co	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Rifle Co	P	P	P	P	P	M	P	P	P	P	P	P	P	P	P

Personnel (P), Materiel (M) and Equal (E)

2. IDENTIFICATION OF PERSONNEL KEY TO UNIT EFFECTIVENESS

From the analysis of each unit's organization and consideration of which functions were required for mission accomplishment, personnel and equipment teams were formed to provide equal increments of capability. Personnel functions required for these teams were identified as essential for mission accomplishment and are listed for each company in the sections of Chapters III, IV, and V. By sampling the unit's ability to rebuild essential teams following combat losses, essential functions critical to reconstitution were identified. These functions are ranked by criticality in Tables 1-3a, (armor units), 1-4a, (artillery), and 1-5a, (infantry). Ranking was accomplished by considering the frequency that shortages of a particular function could not be filled through substitution and in what teams the function was required. The more critical functions are those not easily filled when vacancies occur and those frequently required in essential teams. Note that those functions listed in the top (a) portion in each table are critical to the unit considering only losses uniformly applied to all personnel. It is also of interest (Table 1-3a) that no personnel functions were identified as critical in the tank company. Materiel losses limited this unit's ability to reconstitute combat effectiveness in all cases. There were always more people capable of performing necessary functions (operate tanks) than equipment on hand.

The increase in losses generated by assumed incapacitating drug-abuse levels resulted in identification of additional critical personnel functions. These additional functions, considering both drug abuse and combat damage, are listed in the lower part of Tables 1-3b (armor), 1-4b (artillery), and 1-5b (infantry). The probability that each function is occupied by someone less than twenty-five years of age is also specified. Some of the additions to the critical list have a low probability of being less than twenty-five years of age. In Figure 1-3b and 1-5b some probabilities are zero. These functions became critical, possibly from the indirect impact of losses from drug abuse. Substitutes previously available to assume essential tasks are now absent due to drug abuse, resulting in the essential function not being filled. Tasks with a high probability of personnel being less than twenty-five may be lost directly or indirectly from drug abuse.

TABLE 1-3. CRITICAL PERSONNEL FROM COMBAT DAMAGE AND DRUG ABUSE,
ARMORED BATTALION.

a. Personnel Critical From Combat Damage Only

HEADQUARTERS COMPANY	COMBAT SUPPORT COMPANY	TANK COMPANY
TASK	TASK	TASK
S4 S1 INTEL ANAL CO CDR ASST OP SGT C-E STAFF OFF INTEL/OP SCT COMM CHIEF S3 AIR RATT OP	SCOUT SCOUT, HQ SECT SCT DR, HQ SECT SCOUT DR SCOUT PLT LDR MORTAR GUNR MORTAR SQD LDR SCOUT CREW LDR AMMO BEARER CO CDR SCOUT SQD LDR	NONE- MATERIEL LIMITED OR LIMITED BY TOTAL POPULATION

b. Additional Personnel Critical From Drug Abuse

HEADQUARTERS COMPANY	COMBAT SUPPORT COMPANY	TANK COMPANY
TASK P<25	TASK P<25	TASK
RTO .400 SWBD OP/MES CLK .388 TRK VEH MEC .908 CO .000 XO/S3 .000 S2 .000 COMR .134 FLD CE MEC .458	ASST MORT GNR .884 REDEYE GNR .882 SCT PLT SGT .009 MORT CARR DR .884 REDEYE TEAM CHF .509 SCOUT SQD LDR .129 FIRE DIR CHF .114 FIRE DIR COMPUTR .454	NONE- MATERIEL LIMITED OR LIMITED BY TOTAL POPULATION

TABLE 1-4. CRITICAL PERSONNEL FROM COMBAT DAMAGE AND DRUG ABUSE, FIELD ARTILLERY BATTALION.

a. Personnel Critical From Combat Damage Only

HEADQUARTERS BATTERY	SERVICE BATTERY	FIRING BATTERY
TASK	TASK	TASK
CHART OPR	WRECKER OPR	BTRY CHDR
SURV SPC	TYM	FIRE DIR. O
FDC COMP	SR. TYM	CHART OPR
SURY C/P	SR. RECOV OPR	XO
WIRE CH	BTRY CHDR	FD COMP
CH FD CMP	HVY VEH DR	GUNNER
RTT OPR	RECOV VEH OP	AMMO SEC CH
CH. SURV	WVM	HVY VEH DR
INTEL OFF	AMMO HAND	COMO CH
WIRE SPC	SR. HV DR.	CH FIR BTRY
FIRE SUP SGT	MOTOR SGT	GUN SEC CH
SR FD SGT	MAINT SGT	ASST GUN/CAN
TYM	BN SUP SGT	
RECON OFF	LT VEH DR	
WVM	1ST SGT	
FD SPC	MAINT TECH	
BN CHDR	AMMO SUPS	
REDEYE SGT	AMMO SEC CH	
INTEL SGT	HVY VEH DR	
FDO	SR WVM	
REDEYE CH	LT VEH DR	
REDEYE GUN	AMMO OFF	
FO SGT	SUPPLYMAN	
FSO BN	AMMO AGENT	
SR WVM		
S2		
S3		
MOTOR SGT		
RTT SPC		
WIRE SPC		
CHEM SGT		
INTEL SPC		
COMO SPC		
RTT CH		
PLT LDR		
SR COM CH		
OPNS SGT		
FSO BDE		
CARRIER DR		

b. Additional Personnel Critical From Drug Abuse

HEADQUARTERS BATTERY	SERVICE BATTERY	FIRING BATTERY
TASK	TASK	TASK
LT VEH DR .858	AMMO AGENT .858	CARRIER DR .801
REDEYE O .348		AMMO HANDLR .858
		LT VEH DR .958
		WIRE SPC .961
		WPI: MECH .958

TABLE 1-5. CRITICAL PERSONNEL FROM COMBAT DAMAGE AND DRUG ABUSE,
INFANTRY BATTALION (MECH).

a. Personnel Critical From Combat Damage Only

HEADQUARTERS COMPANY	COMBAT SUPPORT COMPANY	RIFLE COMPANY
TASK	TASK	TASK
RATT TN CHIEF	ANTITANK GNR	ANTITANK SQD LDR
RATT OPR	ANTITANK SQD LDR	FIRE DIR COMPUTR
COMM CHIEF	REDEYE GUNNER	ASST PLAT SGT
C-E MECHANIC	REDEYE TEAM CHIEF	DRAGON GNR
WIRE SPECIALIST	ANTITANK SEC LDR	FIRE TEAM LDR
	AST SCT SECT LDR	ANTITANK GNR
	REDEYE SGT	MORTAR SQD LDR
	SCOUT SEC LDR	COMP CDR
	MORTAR GUNNER	RIFLE SQD LDR
	MORTAR PLT SGT	COMM SGT
	FIRE DIR COMPUTR	ANTITANK SEC LDR
	ANTITANK PLAT LDR	MORTAR SECT LDR
	ASST MORTAR GNR	MORTAR GNR
	SCOUT PLT LDR	RIFLE PLT SGT
	MORTAR PLAT LDR	GRENADIER
	FIRE DIR CHIEF	AUTOMATIC RIFLE
	SCOUT	MORTAR SECT LDR
		MORTAR CAR DR
		RIFLE PLAT LDR
		WPNS PLAT LDR
		APC DRIVER

b. Additional Personnel Critical From Drug Abuse

HEADQUARTERS COMPANY		COMBAT SUPPORT COMPANY		RIFLE COMPANY	
TASK	P<25	TASK	P<25	TASK	P<25
BN CDR	.000	ANTITANK PLT SGT	.000	RIFLEMAN	.871
BN EXEC/S-3	.000	ANTITANK CARR DR	.866	ASST AT GNR	.866
S-1/2/3/4	.000	SCOUT DR	.866	AT DR	.866
		MORTAR SQD LDR	.454	CO RTO	.871
		REDEYE SECT LDR	.483	WPN PLT RTC	.884
		ASST ANTITANK GNR	.866	MORT AMMO	.884

SECTION III

OBSERVATIONS AND FUTURE CONSIDERATIONS

This pilot project for using the AMORE methodology to assist in defining the potential impact of drug abuse on combat capability has provided significant insights into how each unit's effectiveness may be uniquely affected by assumed levels of drug abuse. The specificity and quantification of the results highlight which units may require closer attention in controlling drug abuse. It is also now possible to identify those individuals within units that may warrant intensive personnel management in a drug-abuse environment. These same results would apply to any other medical or human behavioral phenomena which is dependent on an individual being less than twenty-five years of age.

It is important to recognize the limitations of this study before applying the results to specific actions or reaching conclusions about the impact of drug abuse on combat capability. The results of this analysis are highly dependent on, and greatly influenced by, three critical factors: (1) unit mission, (2) personnel qualifications, and (3) drug-abuse distribution.

- Unit Mission: Each unit was examined in light of its ability to perform a basic combat function for a short period of time. This selection of mission addresses the most important question first (how well can the unit fight?), but does not consider the long-term aspects of sustained (long-term) operations or readiness implications found in the peacetime training environment. Factors such as fatigue, replacement procedures, logistics and administration play an important role in these situations and, if considered, will have a significant impact on study outcome.
- Personnel Qualifications: The AMORE methodology makes extensive use of substitutability by allowing necessary functions to be

performed by available, qualified personnel. This is a significant part of the analysis as it provides a means of introducing the reality of reconstitution into the methodology. Who is allowed to substitute for whom and how long it takes for a task to be performed are inputs. For this analysis the substitution rules are based on a review of current TOE organizations, specified rank and MOS authorizations, extent of primary, secondary and tertiary training, and suggestions from various service schools. Proficiency in one's own task was assumed. This approach is feasible and highly satisfactory for answering questions concerning organizational structural weaknesses and strengths, but does not necessarily reflect the existing situation. To accurately assess unit effectiveness (or reduction thereof from some degrading mechanism) and identify critical personnel and equipment, input data must reflect those proficiencies, allowable transfers, and substitutions that currently exist.

- Drug-Abuse Distributions A direct correlation between drug abuse and soldiers in Europe less than twenty-five years old was assumed for this study and was the basis for the observations reported. While statistical data is available to show there is no significant drug use in U.S. households for personnel over twenty-five years of age, the converse may or may not be true for soldiers in Europe. Data reflecting accurate probabilities of the phenomena of interest will obviously produce more reliable and usable results.

A study of this nature does not lend itself to full comprehension in summary form; therefore, a more thorough discussion of the methodology is in Chapter 2.

Specifics regarding each unit organization, mission, team-build, MOS, age probabilities, and results for the armor, artillery and infantry battalions are found in Chapters Three, Four, and Five, respectively.

Appendix A contains a complete list of age probabilities by MOS for all nine company-size units.

CHAPTER TWO METHODOLOGY

SECTION I THE PROBLEM

To assist the Army in defining the functional impact on combat capability of a hypothetical distribution of drug use and abuse in current armor, artillery and infantry company-sized units.

SECTION II BACKGROUND

Specific degradation of performance due to drug abuse is not currently known in sufficient detail to accurately measure the impact on unit capability or effectiveness. It is possible, however, to determine which functions are essential to mission accomplishment, and to evaluate the maximum risk a unit takes that a critical function will fail due to some level of drug abuse. This assumes, among other things, that the probability that a particular function is assigned to an individual who uses drugs is known and that the impact of his functional failure on unit effectiveness can be quantified. Government-furnished input satisfied the first requirement by providing the age distribution by MOS of soldiers currently stationed in Europe. The probability that an MOS was filled by a potential drug abuser was assumed equal to the probability of being less than 25 years of age. These age data (listed in Appendix A) along with other required input information were used in the analysis of each unit's effectiveness, using a methodology called AMORE. Described in detail in Section IV, AMORE provides a means of examining the detailed anatomy of a unit in terms of personnel and materiel related to specific missions or tasks as a function of time. AMORE measures unit capability as a function of time, following performance degradation to personnel and materiel in the unit.

The ability of combat arms units to perform their primary mission is critical to combat effectiveness and is the basis for this analysis. Nine company-size units organic to armor, artillery and infantry battalions were examined. A more detailed description of the technical approach follows in Section III. Specific units are discussed in Chapters Three, Four, and Five.

SECTION III

STATEMENT OF WORK AND TECHNICAL APPROACH

1. STATEMENT OF WORK

The following tasks were specified for this study.

- Determine the combat capability for each type of unit as a function of time before and after combat losses but without degradation from drug abuse.
- Specify personnel critical to maintenance of combat capability following combat losses. Include those critical for each type of unit studied.
- Utilizing appropriate DA sources, determine the probability that an individual serving in a given MOS will be younger than twenty-five years of age.
- Assume that only those personnel younger than twenty-five are at risk of performance degradation due to drug use. (Ignore alcohol use.)
- For individuals over the age of twenty-five, assume drug usage probability is zero. For individuals under the age of twenty-five, assume a probability of drug use is .10, .20, .30, and .40.
- For each type unit, interrelate the above to determine the probability (for each level of use) a drug user will be in a critical job or member of a critical team before and after combat losses over time.

2. TECHNICAL APPROACH

The overall approach used to demonstrate the functional impact of hypothetical distributions of drug abuse on these units is discussed in subsequent paragraphs and shown schematically in Figure 2-1, the Technical Approach. The work effort was performed generally in three phases: (1) unit analysis and generation of input data, (2) computer runs, and (3) analysis of the AMORE output. The AMORE

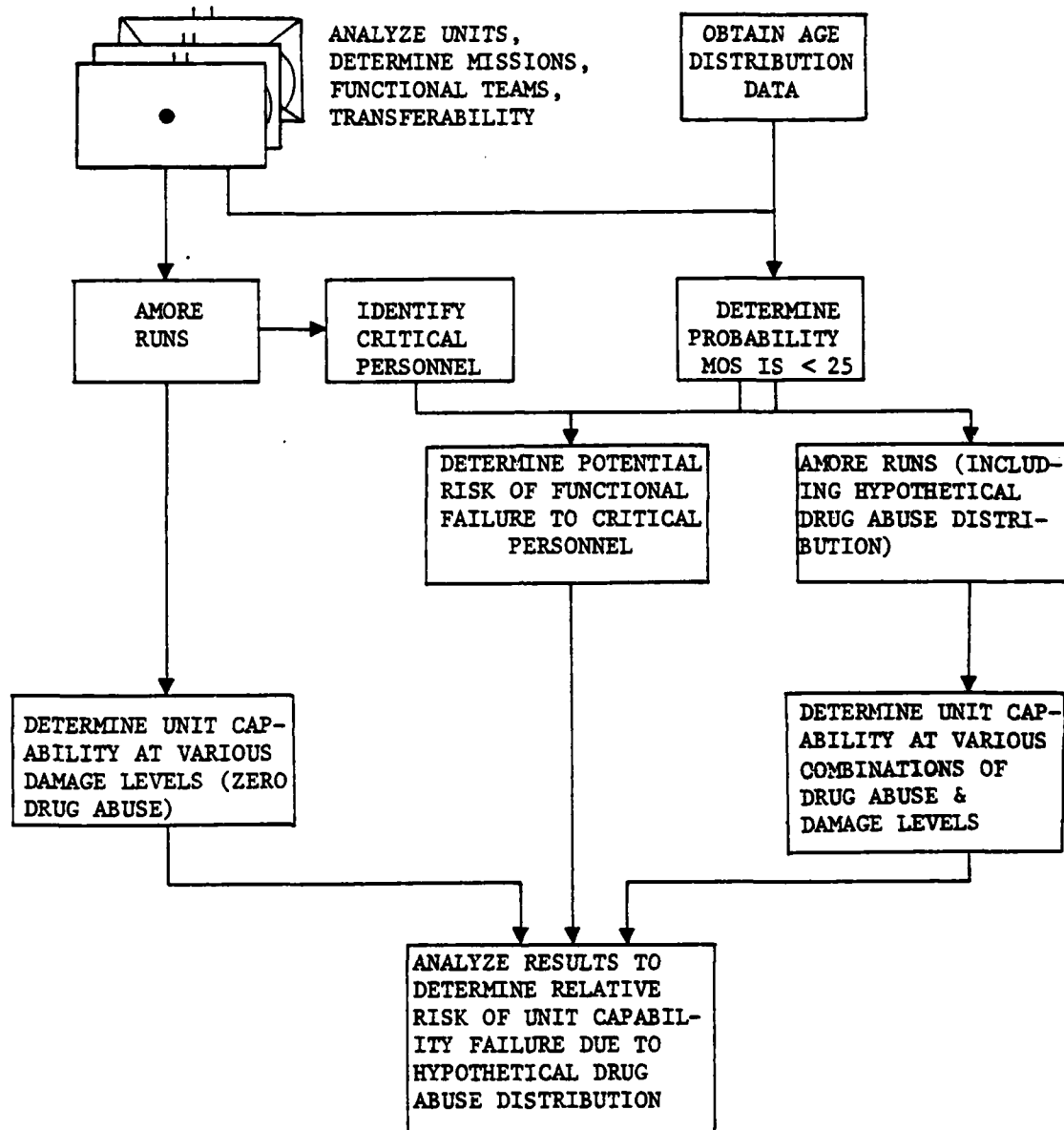


FIGURE 2-1. TECHNICAL APPROACH.

methodology is discussed in detail in Section IV of this chapter, which explains input data requirements and analytical steps to take full advantage of this powerful tool.

2.1 ANALYZE UNITS

Within the framework of a basic combat situation, each unit is analyzed to identify those functions, within that organization, essential for mission accomplishment. Further refinement to a specific mission of conducting defensive operations in a tank-heavy environment for a short period of time (twenty-four hours) is the basis for selection of personnel functions and materiel items essential for mission accomplishment. These functions are then grouped into team requirements, each team representing a slice of the unit's overall combat capability. The numbers of teams and their composition were based on guidance from the U.S. Army Centers for Infantry (Ft. Benning, Georgia), Armor (Ft. Knox) and Artillery (Ft. Sill) as part of previous SAI study efforts. The composition of the personnel and materiel teams is shown for each unit in their respective chapters. Additionally, transferability for both personnel functions and materiel items was defined, as well as times required for these transfers. Times required to repair lightly and moderately damaged equipment were also determined.

The times indicated below were standardized for all units analyzed in this study.

<u>Event</u>	<u>Times</u>
Commander's decision to:	
Transfer personnel	20 Minutes
Transfer equipment	10 Minutes
Repair Equipment	
Light damage (operator repairable)	18 Minutes
Moderate damage (unit repairable)	240 Minutes

It should be noted that for this hypothetical study these input data are notional and do not represent any specific unit or performance goal.

Transfer times, however, are dependent on the dispersal and deployment techniques of each unit, and vary accordingly. Generally, transfer times for personnel to assume other functions are on the order of ten minutes or less within the same section and twenty minutes for transfers to a different section or platoon with that company.

The transfer of vehicles from one function to another followed the same general scale, with an additional time penalty of thirty minutes if communications equipment had to be remounted.

2.1.1 Combat Damage Combinations

Three damage cases (1,2, and 3), which relate to a specified probability of producing a personnel casualty and the associated probability of damage to materiel, are considered during this analysis. In all cases damage was assumed to be caused by Soviet conventional artillery. Probabilities of damage to equipment were computed from current Joint Munitions Effectiveness Manuals (JMEMs). Table 2-1 lists the casualty and damage probabilities developed for this analysis for Damage Cases 1, 2, and 3 (10%, 20%, and 30% respectively).

TABLE 2-1. PERSONNEL AND MATERIEL COMBAT DAMAGE PROBABILITY COMBINATIONS

UNIT	(DAMAGE CASE)	(PER-SONNEL)	^P _D MATERIEL		
			Lt	Mod	Sev
HHC (Arm, Arty, Inf)	1	.10	.20	.14	.02
HHC (Arm, Arty, Inf)	2	.20	.20	.26	.04
HHC (Arm, Arty, Inf)	3	.30	.30	.40	.07
Rifle Co, C/S Co (Arm, Inf)	1	.10	.10	.06	.01
Rifle Co, C/S Co (Arm, Inf)	2	.20	.10	.19	.06
Rifle Co, C/S Co (Arm, Inf)	3	.30	.40	.28	.12
Tank Co	1	.10	.09	.03	.06
Tank Co.	2	.20	.18	.06	.12
Tank Co.	3	.30	.36	.16	.47
Svc Btry (Arty)	1	.10	.05	.01	.01
Svc Btry (Arty)	2	.20	.10	.02	.02
Svc Btry (Arty)	3	.30	.10	.03	.04
FA Btry (Arty)	1	.10	.05	.03	.05
FA Btry (Arty)	2	.20	.15	.06	.10
FA Btry (Arty)	3	.30	.10	.08	.14

2.1.2 Drug and Combat Casualty Probabilities

It was assumed that drug abuse was casualty-producing in order to determine the maximum risk of functional failure in different units. In the combination of the two casualty probabilities (combat and drug abuse), independent probabilities were utilized. A soldier could be a casualty from drugs or conventional munitions. The calculation of the resultant probability for each MOS is demonstrated by the following example:

Red Eye Team Chief, MOS 16P2, Combat Support Company, Infantry Battalion has a probability of .509 of being less than twenty-five. In a unit that has a drug-abuse level of .20 he has a probability of $(.509 \times .20) = .102$ of being a drug casualty. At damage case two he also has a probability of .20 that he will be a casualty from combat damage. Thus, his overall probability of functional failure is:

$$P(\text{combat}) + P(\text{drugs}) - P(\text{combat}) \times P(\text{drugs}) = .20 + .102 - .020 = .281$$

Subtraction of the product $(P(\text{combat}) \times P(\text{drugs}))$ adjusts the resultant probability to reflect the fact that he can be lost to the unit only one time.

The probability of an MOS being occupied by a soldier less than twenty-five years of age was determined from age distribution data furnished by the U.S. Army Military Personnel Center as follows:

$$\text{Probability (MOS <25)} = \frac{\text{Sum of MOS holders <25}}{\text{Sum of all personnel with that MOS}}$$

2.2 COMPUTER RUNS

Using the foregoing data as input, computer runs were conducted for each unit under various damage combinations. Initially, runs were made considering combat damage only to examine the units overall ability to reconstitute mission essential teams and to identify critical personnel. The drug-abuse probabilities were applied to the unit personnel functions, assuming various levels of drug abuse (10%, 20%, 30%, and 40%) in the unit. The full range of drug abuse levels was combined with each combat damage case for these runs (Table 2-1). The output from the nineteen damage combinations of each company-size unit provided data for the analysis. Each damage combination was sampled for fifty iterations to ensure statistical convergence.

TABLE 2-2. COMBAT AND DRUG-ABUSE DAMAGE COMBINATIONS
EXAMINED FOR EACH COMPANY-SIZE UNIT

COMBAT DAMAGE CASE	DRUG ABUSE LEVELS				
	0	.10	.20	.30	.40
0		X	X	X	X
1	X	X	X	X	X
2	X	X	X	X	X
3	X	X	X	X	X

2.3 ANALYSIS

The output of the damage runs was analyzed to determine the cause of limited unit effectiveness and to assess the relative risk among units for functional failure due to drug abuse. Personnel skills were identified as to their relative criticality to unit reconstitution following combat losses. The impact of additional losses from drug abuse to those skills previously identified as critical was also assessed from analysis of the output.

Unit Effectiveness Unit effectiveness was defined as the number of teams the unit could form and expressed as a percentage of the maximum number of possible teams. For example, a rifle company was organized into eighteen teams. Each team was built around the fire team of the rifle squad.

If, due to losses, the unit could form only nine teams, the unit would be reported as fifty percent effective. Both equipment and personnel effectiveness are considered in evaluating unit effectiveness. The difference in unit effectiveness following losses from drug abuse is a measure of their relative risk to failure from drug abuse.

To quantify this relative risk to functional failure from drug abuse at the various damage cases, a convenient ratio was developed. This ratio represents unit tolerance to increased drug abuse and is the measure of the ability of an organization to sustain its effectiveness in a drug-abuse environment. It is defined as the ratio of percent personnel effectiveness lost to percent increase in drug abuse. A higher ratio indicates a greater relative risk due to drug abuse. For example, a unit that experienced a loss of twenty percent in effectiveness when the incidence of drug abuse increased by forty percent would have a tolerance ratio of .50 (20/40). Another unit may lose thirty percent in effectiveness for an increase in drug abuse of ten percent. That unit's tolerance ratio is 3.00.

Critical Personnel The model determines which personnel functions could not be satisfied during each iteration and records the average shortages for all runs. These shortages are analyzed to determine which functions caused the model to "choke" as it tried to build the maximum number of teams. For example, the rifle company may have been capable of forming only nine teams because of a shortage of squad leaders. The model would indicate that ten teams could not be built from the survivors, and the squad leader function caused a choke at team ten. The average number of times this skill was short would also be shown. The squad leader function is now considered critical to the unit's ability to reconstitute mission capability. By sampling the unit at several damage levels, the number of times a particular function, causes the unit to choke can be used to rank those essential functions in terms of criticality. The more frequently a unit chokes on a particular function, the more critical the function is to the unit.

Required Substitutes Required substitutes are also identified, and are those personnel functions not essential for mission accomplishment, but are required to substitute for and perform the function for those positions defined above as critical.

For example, the executive officer's function may not be necessary for short periods of intense combat, but he may be required to assume command in the commander's absence. This makes him more important to the unit than other "non-essential" functions not required to substitute for some critical function.

SECTION IV

ANALYSIS OF MILITARY ORGANIZATIONAL EFFECTIVENESS (AMORE) METHODOLOGY

The fundamental methodology employed during the execution of this study effort was the Analysis of Military Organizational Effectiveness (AMORE). This section describes this tool.

1. BACKGROUND

The AMORE methodology was developed to translate input degradation of elements of military organizations into output capability as a function of time. The elements refer to personnel and materiel that comprise the organization. The methodology substitutes a quantitative process for what in the past has been an assumptional process. The assumption process related combat attrition to a unit's remaining combat viability by making explicit or implicit linear assumptions regarding this linkage. As an example, thirty-percent personnel incapacitation has been translated into seventy-percent unit effectiveness. This in turn has been used as a combat defeat criterion, and in some studies or war games, units receiving this level of personnel incapacitation have been precluded from further participation until replaced wholly or in part.

Other analyses treat the materiel aspects of degradation. In high-resolution modeling, "killer-victim" scoreboards result from stochastic engagement processes. In large-scale, low-resolution models, remaining weapons are scored for their firepower, mobility, or survivability contribution without regard to personnel contributions.

In applying this type of assumptional transition, the contribution of certain key features of military organizations have not been assessed. Some of these contributions are discussed below:

- The synergistic interactions between personnel skills and materiel as they merge functionally to accomplish the missions. These effects are often ignored.
- The linear translation of personnel attrition into unit degradation does not differentiate between units of highly trained personnel and units of lesser trained personnel.

- The organizational reconstitution options open to unit commanders and subordinates in the chain of command are ignored in the assumptional transition process. This leadership role represents a potentially significant increase in unit capability.
- The time-dynamic aspects of remaining unit capability that can be regenerated after degradation are normally lumped into a single step function. In reality, the process of attrition may be random, whereby key skills in one combat functional element are lost, other skills in other elements of the same unit are also lost and materiel items in yet other elements are damaged or destroyed. This random culling process may result in an initial level of unit combat capability that is much lower than applying a straight percentage related to incapacitation or equipment damage. As an intuitive example of this culling process, consider an organization consisting of ten functional elements with four personnel and/or items of equipment essential to each element. If the probability of attriting any one of the personnel or materiel is .3, then the probability of getting at least one is equal to $1 - (1 - .3)^4 = .7599$. It can be shown that the expected initial remaining capability is approximately 2.4 functional elements versus the seven obtained from the linear assumption. In reality, time-dynamics provide the potential for regrouping surviving personnel and equipment into other fully functional elements. Additional functional elements can also be formed by repairing damaged equipment (within organizational capability), by substituting cross-trained skills (a fire team leader becomes a squad leader) or by substituting equipment (the supply truck becomes a prime mover for a howitzer).
- The functional relationships among elements of different organizations influence the time-dynamics of organizational capability. Functional elements, while moving, shooting, communicating, or maintaining in concert, can be considered to be operating serially or in parallel. For example, if one tank team is knocked out, others can continue their parallel function. In other units, however, some functional elements are dependent on others, or operate in series. An artillery gun crew is

dependent upon a fire direction element and, over a longer time horizon, on command and control. In organizations where a number of tasks occur through a series of functional elements, organizational capability is more easily impaired than in units where most of the tasks are executed in parallel.

- Many organizations have a reserve capacity in terms of skills which are non-essential for specific missions. While this reserve capacity is also subject to combat degradation, some members should be available for substitution into more critical skills lost during combat.

2. DESCRIPTION

The dynamics of interactions within an organization after degradation are complex. Ignoring these complex interactions and the potential for change implicitly assumes that these interactions do not make a difference. The AMORE methodology has shown this to be an invalid assumption. In Figure 2-2, the organizational capability of two different types of Warsaw Pact units is compared as a function of time after personnel incapacitation.

Two damage levels are shown: thirty percent and fifty percent personnel incapacitation with corresponding equipment damage. Compare the low initial capability of each unit and note also that the initial capability differs by type of organization structure. The tank company is a simple organization. Its functions consist of tank elements that move and shoot under command and control of the company headquarters. The artillery unit is a more complex unit having a fire direction function in series with the gun and crew function. The observed initial "functional shock" is greater for artillery battery capability than for the tank company.

Unit capability represents the proportion of functional elements (equipment and crew) that can perform the unit mission. The curves represent the recovery of the expected value of unit capability as a function of time. The curves result from a statistically significant number of replications of personnel and equipment damage combinations to these organizations. Various considerations can raise or lower the expected recovery capability of any unit. Accordingly, the

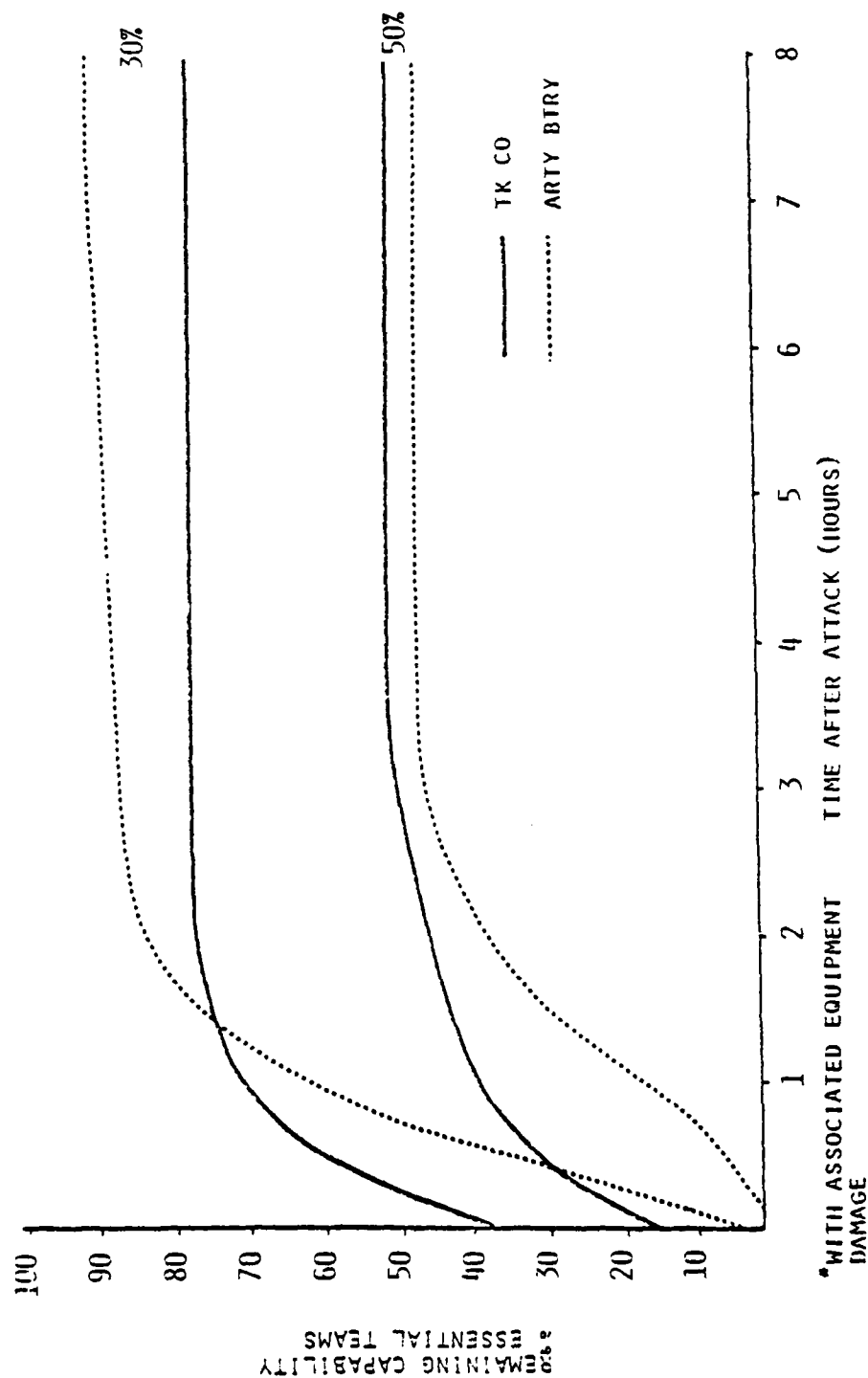


FIGURE 2-2. COMPARISONS OF COMBAT CAPABILITY OF DIFFERENT ORGANIZATIONS AFTER ATTACK

AMORE analysis of any organization will be directed towards discovering ways to increase the total remaining capability, the rate of recovery.

In the Warsaw Pact example, the response of the two units is different for the same levels of personnel incapacitation. However, the artillery unit has the potential for more rapid recovery to a higher level after thirty percent personnel incapacitation. This is due to the reserve capacity in that organization. At higher levels of incapacitation, the flexibility of that reserve capacity yields to the more complex functional relationships inherent to artillery organizations. This observation leads to a new concept of hardness for military combat organizations. Organizations with hard materiel, a high degree of cross-training (or a few skill requirements), and a reserve capacity have a potential for high resiliency. In contrast, organizations austerey manned and trained, with complex functional interrelationships, and fragile equipment, are potentially brittle.

The AMORE methodology replaces the assumptional process through a detailed analysis of the anatomy of an organization and its recovery after personnel casualties and materiel damage. The following are specifically considered:

- Combinations of personnel and materiel damage.
- Personnel and materiel interactions as they merge to form functional teams required for increments of combat capability.
- The state of training and cross-training of individual members of the organization, to include skill transferability.
- Substitutability and repairability of equipment.
- Required functions for effective mission performance and the relationship of these functions. Are they in parallel? In series?
- The organization's ability to reconstitute its functions and regenerate combat capability over time as a function of personnel incapacitation and materiel damage.

3. THE AMORE PROCESS

Input Data Preparation. The AMORE methodology presents a structured approach to the building and integrating of functional teams of an organization. The following steps outline the approach and can be used to develop input data for the AMORE software.

3.1 DETERMINE UNIT STRESS MISSIONS

Unit missions should be considered in terms of demands on rare skills and low-density equipment within the organization and simultaneous demands or multiple functions required to accomplish the mission. Demands on rare skills and low density equipment are rather obvious. An example of simultaneous demands are "fire" and "maneuver" during the attack on an objective by an infantry unit.

The mission of "fire for effect" for an artillery battery places more demands on personnel skills than interdiction fires. The key difference is the demand for a forward observer. In the "fire for effect" mission the forward observer performs the target surveillance function. In the interdiction mission the fire direction center does not require input from the forward observer.

A mission which includes all or more of the functions of like missions can be considered a "stress" mission and will generally provide the most information about the unit performing its combat function. Complex organizations may require analysis of more than one mission to gain total insight to organizational development.

3.2 PERFORM FUNCTIONAL ANALYSIS OF MISSION AND UNIT

It must be determined what functions must be performed to accomplish the stress mission and how the functions relate to each other. As an example, the artillery "fire for effect" mission demands as a minimum the following functions: target detection, target identification, target assignment, target engagement, and target surveillance. There may be implied subfunctions such as movement to contact or, in some cases, survival to allow subsequent engagements.

The functions required of a unit can be derived from the unit's mission. Tables of Organization and Equipment (TOE) also have a functional logic to them: company and platoon headquarters for command and control, tank squads for the tank teams, etc. For new concepts and new tactics it is wise to reverse the above sequence, i.e., to let the

required functions define the unit's TOE. For example, when groups of missions are considered, do they require command and control? maintenance? other services?

3.3 DETERMINE SKILL REQUIREMENTS FOR FIRST AND SUBSEQUENT INCREMENTS OF FUNCTIONAL CAPABILITY

It is here that the organizational analyst must come to grips with how capability is defined and, in particular, how capability is increased for given missions. He must begin to answer the questions: What are the increments of capability for an artillery battery? Should the first increment include the company commander? Or a section leader? Where should maintenance be included? Should it be among the essential teams for the gun crew mission or should it be clustered as a separate increment of capability?

A helpful technique is to consider the following questions. If only one increment of capability could be built, what skills should it contain? Next, if only two increments of capability could be built, what skills should they contain? The second increment of capability will then be the difference between these two answers. This process is continued until all required functions are accounted for.

The AMORE process is not one which develops tactical concepts, but rather one that reflects tactical concepts.* It places the planner in the shoes of the unit commander confronted with less than adequate resources as a result of combat degradation. He must determine how to reorganize the unit to accomplish the mission. The AMORE methodology can be used to evaluate different orderings of capability increments and different clustering of skills to gain insight as to their impact on the potential recovery of a unit after degradation and the resultant capability of the unit to accomplish the mission.

*Although the process can aid conceptual organizational development.

3.4 IDENTIFY ARMAMENT, MOBILITY, COMMUNICATIONS OR OTHER EQUIPMENT ASSOCIATED WITH EACH FUNCTIONAL AREA

The next step in the AMORE process is to correlate organizational materiel (or conceptual materiel) with functions. The personnel skills ordered for the various increments of capability need the tools of their profession to accomplish the required functions and reflect the mission being modeled. The real decision on the ordering of increments of capability was made during the previous step, but the sophistication of this step lies with selection of communications equipment, maintenance tools, generators, etc. It is easy to assign a tank to the fourth tank team and, in general, equipment assignments track with previous skill assignments. But there may be some tools, radios, etc., for which it is difficult to determine whether they are essential for a particular function or mission. Sensitivity analysis is advocated in these instances. In the sensitivity analysis, the organizational analyst must assess the trade-off of making an item essential with the resulting impact on unit resiliency versus not requiring it to be present (i.e., not essential).

3.5 ASSIGN MINIMUM SKILLS AND MATERIEL TO THE FIRST TEAM AND SUBSEQUENT INCREMENTS OF FUNCTIONAL CAPABILITY

The next step is to consider the merger of personnel and materiel to form teams. The previous steps considered personnel and materiel skills alone. The addition of materiel may generate the need for more skills (to maintain, to hookup, etc.). The analyst will undoubtedly encounter constraints in terms of available personnel and equipment. Austerity must be stressed. Before adding elements to teams, the personnel skills and materiel items must pass the test: are they essential to the performance of the particular increment of capability? Or, conversely, can the increment of capability can be performed without any particular skills or materiel items? The organizational analyst may have to repeat previous steps to refine the ordering of essential increments of capability. The axiom to be followed is to exclude personnel skills and materiel items without which the function can still be performed. The addition of a particular skill or item of equipment to a team can best be justified by carefully considering the functional analysis of the mission and by adding personnel or equipment only where the marginal productivity is high in terms of functional performance. When the issue is in doubt, the AMORE methodology can be used to determine the cost in terms of recoverable capability for the additional skill or item of equipment.

3.6 DEVELOP PERSONNEL TRANSFERABILITY MATRIX

For a unit commander in combat, the balancing of remaining resources against mission requirements is essentially a supply and demand problem. Commanders are always reconstituting their units, even in peacetime, by considering available assets and demands for current mission(s). Accordingly, the exercise of command becomes a continuous reallocation of unit resources to meet demands of the mission(s). In the AMORE methodology, the allocation potential is represented by personnel and materiel transferability matrices, such as the one shown in Figure 2-3.

	TOE	P1	P2	P3	P4	P5	P6
P1 PLT CMDR	3	0	0	0	0	0	0
P2 PLT SGT	3	0	0	0	0	0	0
P3 TK CMDR	11	10	5	0	0	0	0
P4 TK GUNNER	17	30	15	10	0	0	0
P5 TK LOADER	17	-	-	40	30	0	10
P6 TK DRIVER	17	-	-	40	30	10	0

FIGURE 2-3. PERSONNEL TRANSFERABILITY EXAMPLE.

A portion of the potential transferability of personnel in a tank company is shown. The rows represent the supply of skills available to perform the tasks identified by each column. For particular missions and particular increments of capability, the AMORE software selects available skills from the columns to meet team requirements. Entries in the matrix reflect the "cost" for a skill (row) to perform a particular task (column). Cost in this example is time for a row to assume a column task. The entries shown could also represent training

costs or the time actually required to perform the task. The dimension of the entries is chosen to fit the problem under examination. Values along the diagonal (the intersection of row and column) represent a skill filling its own job. In all cases in the above example, a zero means there is no cost in time for that skill to become operational in the indicated task at an acceptable level of capability.

The intersections of row and column off the diagonal represent opportunities for cross-assignment. Where the number is other than zero (such as row 4, column 1 - Tank Gunner substituting for Platoon Commander) the number represents the time in minutes for that substitution to reach an acceptable level of capability. Where there is no number (as in row 6, column 2 - Tank Driver substituting for a Platoon Sergeant) the potential for substitution is not recognized. These potential transfers are obviously a function of the mission and situation under consideration. For example, an analyst may preclude transfers because of rank differential for one mission but allow them for another.

This step of the input data analysis requires one or two decisions per row/column cell. Can the row skill substitute for the column demand for the particular mission under consideration? If the answer is yes, what is the cost for the substituted skill to attain acceptable operational capability in combat? Earlier steps in the analysis will have provided additional insights for making these decisions. Transfer rules should be informally developed to provide consistency to the decisions.

The filling of the personnel transferability matrix begins to round out the establishment of a baseline organization. For the baseline organization the inputs usually represent a "best case." For specific cases to be studied, the transferability matrix can be systematically changed with respect to the honoring of cross-assignment potential or the cost required to accomplish it.

3.7 DEVELOP MATERIEL SUBSTITUTABILITY MATRIX

While equipment cannot be cross-trained, it can be designed to perform more than one function. For example, a platoon leader's tank can become the company command tank with a zero time penalty. Other line tanks in the company can also become the command tank but a time penalty should be assessed since time is required to exchange radios to provide the proper netting capability for the substituted command tank.

Developing the materiel substitutability matrix also requires one or two decisions regarding each row and column intersection: Can the row item substitute for the column demand item? If so, is there a cost required to make the item combat ready for its new function within unit resources?

3.8 BUILD PERSONNEL AND MATERIEL TEAMS BY FUNCTION UP TO MAXIMUM NUMBER SELECTED

This step coordinates the previous steps and establishes the incremental capability of the organization being considered.

	NUMBER OF TEAMS							
	1	2	3	4	5	6	7	8
COM CMDR								1
PLT CMDR				1				
PLT SGT		1				1		
TK CMDR	1		1		1		1	
TK GUNNER	1	1	1	1	1	1	1	1
TK LOADER	1	1	1	1	1	1	1	1
TK DRIVER	1	1	1	1	1	1	1	1

FIGURE 2-4. INCREMENTS OF TANK COMPANY PERSONNEL CAPABILITY FOR PROVIDING FIREPOWER.

Figure 2-4 shows an example of the buildup of team capability for a Tank Company. The increments of capability are for personnel skill teams. There is a collateral set of input data for materiel items required for each increment. The AMORE software develops separate and integrated insights for personnel and materiel. Figure 2-5 shows a portion of the team incremental capability for required materiel items.

	NUMBER OF TEAMS							
	1	2	3	4	5	6	7	8...
CO TK (VRC-12, GRA-39)								1
KEYGUN, KYK-13	1							1
PL CO TK (VRC-12, PLRS)				1				
P SGT TK (VRC-12, PLRS)		1				1		
OTHER TANKS	1		1		1		1	
SPEACH SECURITY (KY-57)	1	2	1	2	1	2	1	2
NIGHT VISION GOGGLES (PVS-5)	1	1	1	1	1	1	1	1
MASK, CHEM-BIO, PROTECTIVE	4	4	4	4	4	4	4	4

FIGURE 2-5. INCREMENTS OF TANK COMPANY MATERIEL CAPABILITY FOR PROVIDING FIREPOWER.

The increments of capability do not have to be either linear or homogeneous. There is no reason why the fourth or seventh increment of capability could not have been maintenance oriented. Or, maintenance could have been integrated with the tank teams themselves. The final building of the teams is reserved for the last step to accommodate the insights developed during the building of the transferability matrices. In turn, the transferability matrices were developed with some knowledge of the incremental capability needed, as developed in earlier steps.

The development of the matrices and the incremental capability require a detailed and structured thought process. Once developed, the input data together with the AMORE software provide a powerful analytical tool to evaluate unit organizational effectiveness and provide significant insights into such diverse features as training, replacement and assignment policy, readiness, equipment density, and repair priority, to name a few.

4. INPUT DATA PRODUCTS REQUIRED

A summary of data elements required to run a single case, using the AMORE methodology, is listed below. Input data used in this study

was based on guidance received from the centers at Ft. Benning (Infantry), Ft. Knox (Armor) and Ft. Sill (Artillery) in support of other studies conducted by SAI for the U.S. Army.

- Current tables of organization and equipment
- Personnel transferability matrix
- Personnel essential team requirements
- Significant materiel list
- Materiel transferability matrix
- Materiel essential team requirements
- Materiel repair times and vulnerability considerations
- Commander's decision times

A set of such input data is required for each unit and each mission considered (if different).

5. AMORE SOFTWARE FUNCTIONAL DESCRIPTION

This paragraph describes how the AMORE software manipulates the input data to assist in the analysis of military organizations. A block diagram of the AMORE software is shown in Figure 2-6. The number in each block refers to the paragraphs below:

5.1 DEGRADATION OF ORGANIZATIONAL PERSONNEL AND MATERIEL ELEMENTS

The Joint Munitions Effectiveness Manual (JMEM) methodology is normally used to derive relative probabilities of attrition of personnel and relative probabilities of equipment damage or destruction. Using these JMEM results, units can be compared in three different ways:

- After receipt of the same personnel incapacitation and equipment damage combinations,
- After receipt of the same attack level (same number of volleys of artillery, for example),
- After receipt of correlated attacks (e.g., when a tank company is receiving some level and a headquarters and service company is receiving another level).

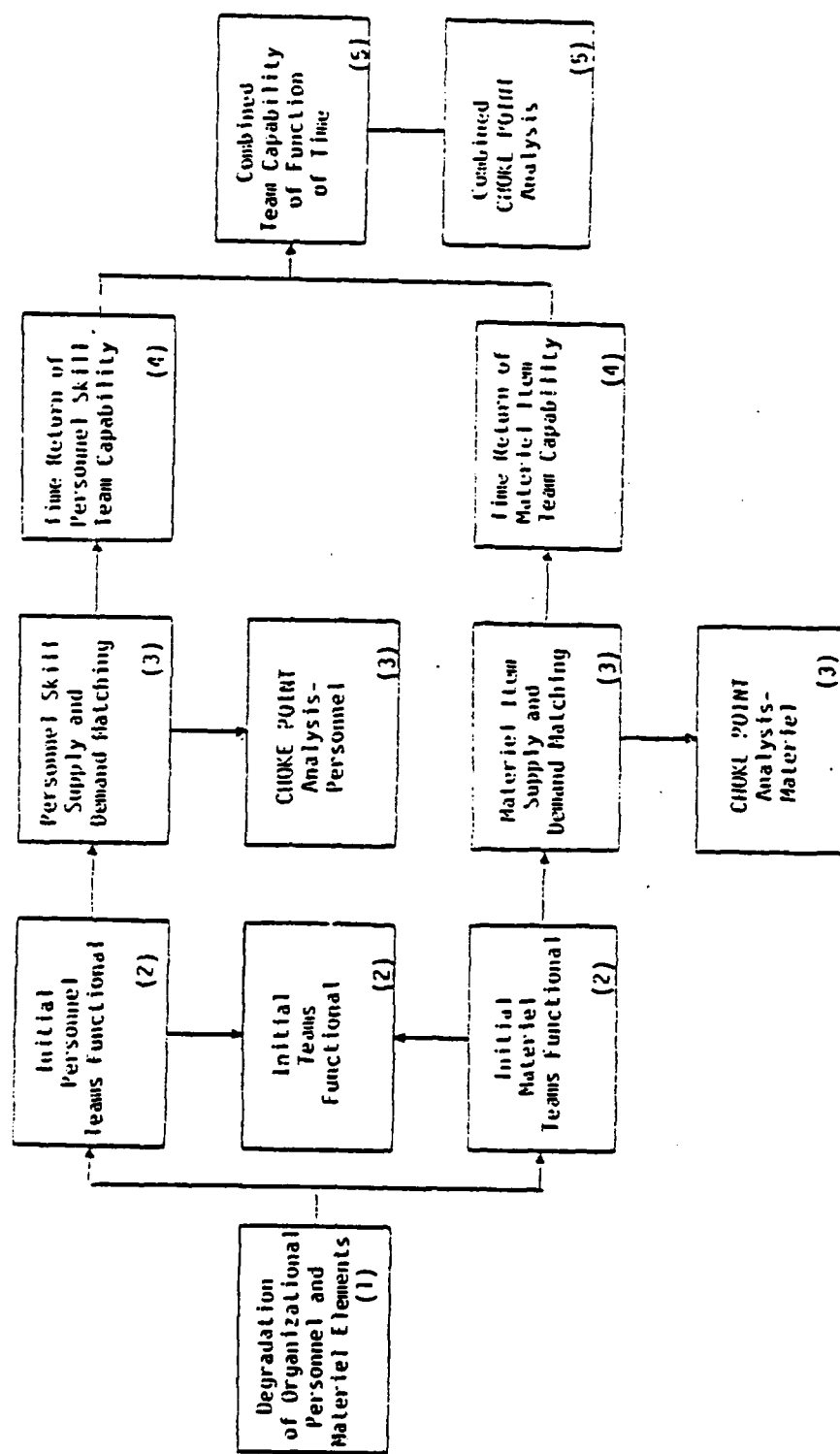


FIGURE 2-6. AMORE SOFTWARE PROCESS

The AMORE software can accept different damage probabilities for each item of equipment. Additionally, specific personnel degradation of a unit can be applied or the damage combinations can be applied stochastically. Monte Carlo techniques are used to assign personnel casualties within the model keeping count of the number and type of each skill remaining. A more detailed process occurs for equipment. Equipment is sorted into damage that can be repaired within the section or team, damage that cannot be repaired by the team but can be repaired within the company, damage that must be evacuated for repair and, finally, undamaged equipment according to these categories. The model keeps count of equipment according to these categories.

As a practice, baseline organizations are also run with zero damage combinations. This validates the input data and confirms that the organization can do what it is designed to do.

5.2 INITIAL FUNCTIONAL CAPABILITY

After applying personnel and materiel degradation factors, the model compares personnel and equipment remaining with skills and equipment required by the essential team inputs. This initial comparison occurs before any transfers have taken place or before any items of equipment have been substituted or repaired. The model calculates this separately for personnel and materiel, and the combination of the two. The model is also able to analyze multiple functions such as firing and mobility. Figure 2-7 shows a hypothetical sequence for firepower and mobility, by personnel and materiel teams.

Repl- cation	Firepower			Mobility			Capability
	Per- sonnel Teams	Mate- riel Teams	Fire- power Teams	Per- sonnel Teams	Mate- riel Teams	Mobil- ity Teams	
1	4	2	2	8	5	5	2
2	5	4	4	7	9	7	4
3	6	4	4	8	8	8	4
4	4	5	4	9	8	8	4
5	6	3	3	7	8	7	3
Average	5.0	3.6	3.4	7.8	7.6	7.0	3.4

FIGURE 2-7. INITIAL CAPABILITY ANALYSIS IN TERMS OF TEAMS

Considering the personnel skills that must be present for firepower delivery, five separate AMORE iterations produced a range of four to six personnel teams which could be built to deliver firepower. The expected capability is 5.0 personnel teams containing the necessary skills to deliver firepower. The materiel column gives the same analysis for materiel oriented to firepower. In the above example, materiel generally dominated; i.e., built less teams than personnel. The exception is in the fourth iteration. The dominant of the two results in the number of teams that can fire by virtue of remaining personnel skills and equipment.

The three columns under "mobility" reflect the same process. It should be noted that the response of personnel and materiel are closer. Also note the combined average in each case is less than either of the two separate averages. The seventh column results from the dominant effect of columns three and six. In the example shown, firepower was always dominant.

AMORE output includes confidence intervals for each column. A sufficient number of iterations are run to minimize the variance of the expected capability.

5.3 SUPPLY AND DEMAND MATCHING

During each iteration the model establishes the maximum number of essential teams that can be formed by (as in the above example) personnel/firepower, materiel/firepower, personnel/mobility, and materiel/mobility. It accomplishes this by a binary search technique. For example, if the company capability consists of seventeen teams, the process first tries to build nine. If nine can be built, it tries for thirteen; if not it tries for five. The process continues to split brackets until a point is reached where n teams can be built and $n+1$ cannot.

To build teams, the model solves a transportation algorithm. It allocates the remaining supply of skills and equipment according to the rules established by the transfer matrices to the demands of the n teams constructed during the binary search process. The times in the transfer matrices are used as a cost. The solution minimizes the average expected time to build teams.

When the model arrives at the point where it can build n but not $n + 1$ teams, it determines which skill absences prevented the building of the $n+1$ team. It also reflects what skills were surplus to $n+1$ teams. These are inputs to a choke analysis which allows the

determination of critical personnel skills. In each case, the frequency of demands not filled and surplusses remaining are indicated along with the distribution of the number of times n teams could be built but not $n+1$, for all n .

A similar process is repeated for materiel teams, leading to a choke analysis for materiel. The choke analysis reveals marginally critical equipment items along with items that are preponderantly surplus at a given level of capability. This analysis provides a basis for materiel tradeoffs within the organization. Equipment repair times are considered in the transportation algorithm solution and can be used to model the tradeoff between organizational and intermediate-level maintenance.

5.4 TIME RETURN OF TEAM CAPABILITY

The times used in the transferability matrices and in the estimates of repair times are sampled stochastically for determination of when the next team can be built. A stochastic model is used to reflect that while a commander may estimate four hours to repair a radio, it may actually take two or six. Accordingly, only when the skills for n ordered personnel teams are assembled does their capability get counted. This same process occurs for equipment and results in team counts at user-specified time increments (such as two-tenths of an hour). Thus, the software outputs team capability for replication as a function of time. This is partitioned at each time slice separately for personnel and materiel, and by function. The dominant number of teams becomes combined capability as a function of time.

Other times that can be included in the process are times required to move personnel and equipment. These would also be sampled stochastically and folded in with other times to calculate the return of given elemental capabilities.

5.5 COMBINED TEAM CAPABILITY AS A FUNCTION OF TIME

The model merely makes the required dominance comparisons of personnel and materiel teams at each time increment specified. The most restricting capability for each iteration becomes the capability of the organization at each particular point of time. Results of all iterations are averaged to obtain expected values. The model then determines the dominant skills or items which lead to the final team capability and provides a choke analysis summarizing the results of all iterations.

CHAPTER THREE ARMORED BATTALION

SECTION I GENERAL

The primary mission of the armored battalion is to close with and destroy enemy forces, using fire, maneuver, and shock effect. In combat operations it organizes, commands, and controls combined-arms teams through cross-attachment of armored and mechanized infantry companies. This chapter discusses the analysis of those companies organic to the armored battalion. Other units, artillery and infantry, are addressed in Chapters Four and Five, respectively.

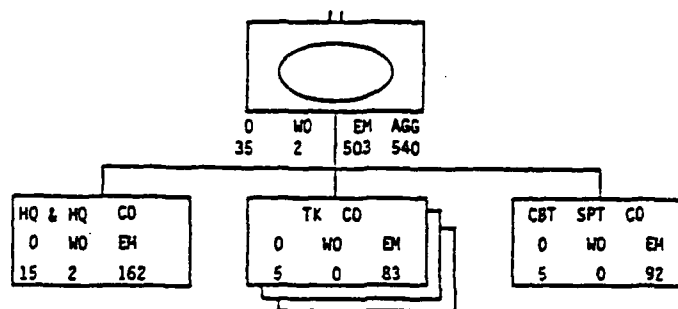
The organization of the armored battalion is shown in Figure 3-1. The battalion has three unique company units:

- Headquarters Company
- Combat Support Company
- Tank Company

This analysis assumed that these companies were engaged in intensive combat, defending against a tank-heavy force for a short period of time (twenty-four hours).

Each company was analyzed, using the AMORE methodology described in Chapter 2. Integral to this methodology is the examination of a military unit, in terms of essential teams, which are composed of the necessary personnel and materiel to perform the basic functions of the unit. The effectiveness of the unit is measured by the capability to form these teams after the unit has sustained damage.

The TOEs were examined in detail, and all unique MOSs were identified and matched with the requirements to accomplish each unit's basic combat mission. Functions not essential to the basic mission, such as mess and supply, were not required in the essential teams, but were available to substitute for shortages in essential positions. Each company was analyzed at four damage levels, called damage cases 0, 1, 2, and 3. Each case relates to a specific probability of producing personnel casualties and associated damage to equipment. Combinations of combat personnel casualties and associated materiel damage to equipment are listed in Table 3-1. Drug abuse in each of



COMBAT MISSION

To close with and destroy enemy forces, using fire, maneuver, and shock effect.

ASSUMED MISSION FOR ANALYSIS

To organize, command, and control combined arms teams to engage the enemy with fire, maneuver, and shock effect during defensive operations for short period of time.

FIGURE 3-1. ARMORED BATTALION, ARMORED AND MECHANIZED INFANTRY DIVISION.

Table 3-1. Damage Combination Probabilities For Personnel and Corresponding Equipment Damage For Combat Damage Cases, Armored Battalion

UNIT COMPONENTS			DAMAGE		CASE	
			0	1	2	3
<u>HEADQUARTERS & HEADQUARTERS</u>						
	PERSONNEL CO.		0	.10	.20	.30
	EQUIPMENT:	LT.	0	.20	.20	.30
		MOD	0	.14	.26	.40
		SEV	0	.02	.04	.07
<u>COMBAT SUPPORT CO.</u>						
	PERSONNEL:		0	.10	.20	.30
	EQUIPMENT:	LT	0	.10	.10	.40
		MOD	0	.06	.19	.28
		SEV	0	.01	.06	.12
<u>TANK CO.</u>						
	PERSONNEL:		0	.10	.20	.30
	EQUIPMENT:	LT	0	.09	.18	.36
		MOD	0	.03	.06	.16
		SEV	0	.06	.12	.47

the units was considered at four levels (10, 20, 30, and 40 percent) for each of the combat damage levels. The three companies are discussed in turn in Sections II, III and IV. Overall observations and findings for the battalion are summarized in Section V.

SECTION II HEADQUARTERS COMPANY, ARMORED BATTALION

1. GENERAL

The organization of the headquarters company is shown in Figure 3-2. To accomplish its mission, the headquarters company must organize, command, and control combined-arms teams which are engaging the enemy with fire, maneuver, and shock effect for a twenty-four hour period. Supply, much of the maintenance, mess activities, and medical activities were not considered essential in this situation.

In Table 3-2, the personnel functions for headquarters company are listed by MOS with the probability that MOS is occupied by personnel less than twenty-five years old. The probability of being less than twenty-five years of age is assumed to equal susceptibility to drug abuse.

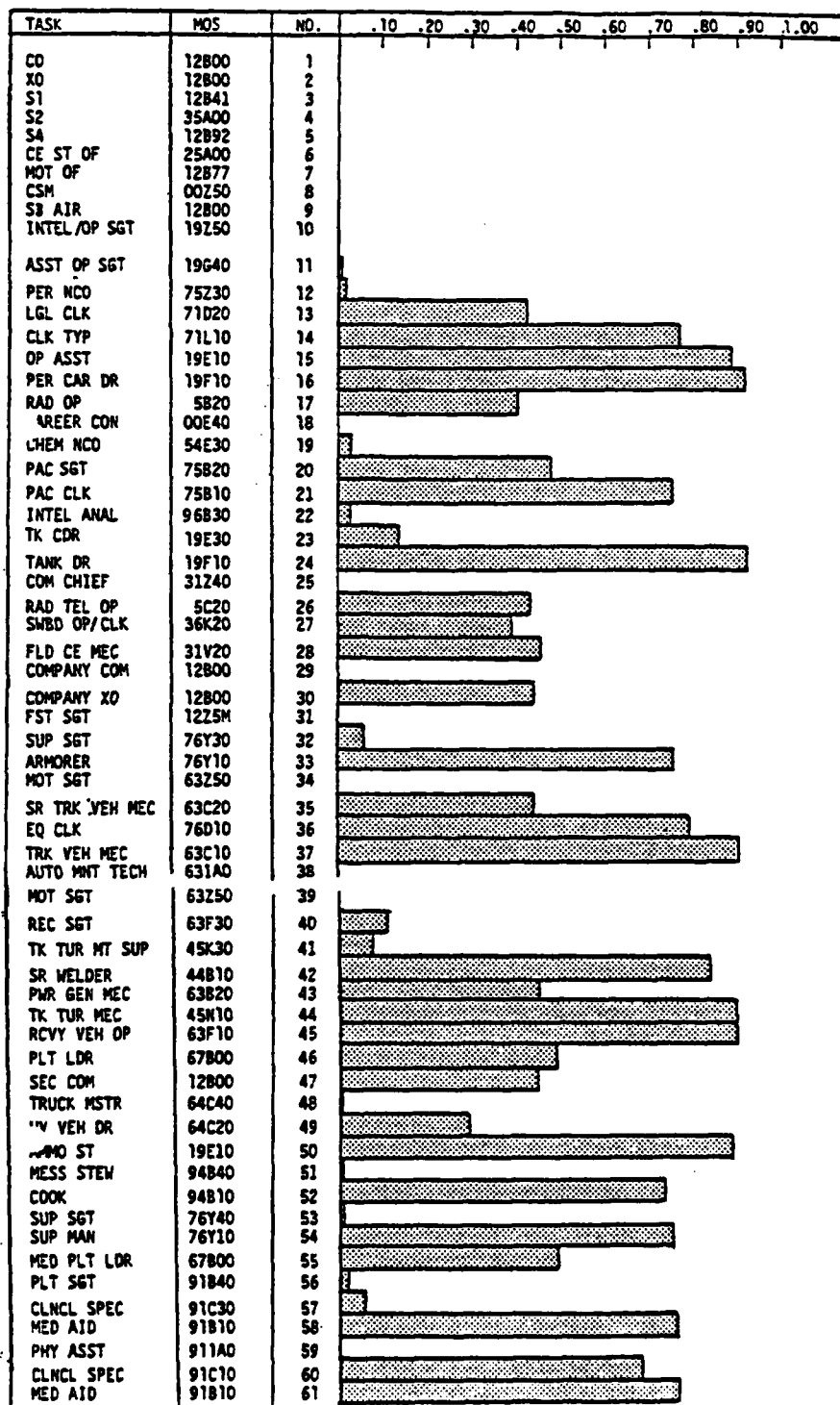
2. TEAMS AND TRANSFER MATRICES

The personnel requirements for forming teams for the basic mission are displayed in Figure 3-3. The personnel tasks cover the basic function of command, communication, intelligence, and some maintenance (track vehicle mechanic). This limited maintenance capability provides repair to vehicles with light and perhaps moderate damage, necessary for the conduct of the defense during the assumed brief period of intense combat.

A maximum of five essential teams was established for the headquarters company. Team one requires the bare minimum to perform at the twenty percent effectiveness level. These functions consist of the battalion commander, staff officer, operations assistant, driver, tank commander, field switchboard operator, and two track-vehicle mechanics. These team requirements are shown cumulatively in Figure 3-3, for example the entries in column two (for team two) are the totals for the required personnel tasks for both team one and two. For team two, an intelligence operator, radio operator, company commander and a different staff officer are added to those functions required for team one. Total requirements are shown in column five.

The personnel transfer matrix is at Figure 3-4, and indicates the time in minutes for a task (row) to assume a function (column).

TABLE 3-2. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE. HEADQUARTERS COMPANY, ARMORED BATTALION.



TASK	NO	TOE	TOE TEAMS				
			1	2	3	4	5
CO	1	1	1	1	1	1	1
XO/S3	2	2		1	1	1	1
S1	3	1	1	1	1	1	1
S2	4	2					1
S4	5	1				1	1
CE ST OF	6	1				1	1
MOT OFF	7	1					
C S M	8	1					
S3 AIR	9	1			1	1	1
INTEL OP	10	2		1	1	2	2
ASST OP SGT	11	1					1
PER NCO	12	2					
LGL CLK	13	1					
CLK TYP	14	2					
OP ASST	15	7	1	2	3	4	5
PEP CAR DR	16	6	1	2	4	4	4
RTO	17	4		1	1	2	2
CAREER CON	18	1					
CHEM NCO	19	1					
PAC CLK	20	1					
PAC CLK	21	3					
INTEL ANL	22	1			1	1	1
COMR	23	5	1	2	3	4	5
TANK CR	24	1				1	1
COM CHF	25	1				1	1
RAD TEL OP	26	1				1	1
SNBD OP/MES CLK	27	5	1	1	2	2	2
FLD CE MEC	28	1				1	1
CO CDR	29	1		1	1	1	1

TASK	NO.	TOE	TOE TEAMS				
			1	2	3	4	5
CO XO	30	1					
FST SGT	31	1					
SUP SGT	32	1					
ARMORER	33	2					
MOT SGT	34	1					
SR TRK VEH MEC	35	4					
EQ CLK	36	2					
TRK VEH MEC	37	16	2	2	5	5	9
AUTO MNT TECH	38	1					
MOT SGT	39	1					
REC SGT	40	3					
TANK TUR MT SUP	41	1					
SR WELDER	42	2					
PWR GEN MEC	43	4					
TANK TUR MEC	44	2					
RCVY VEH OP	45	4					
PLT LDR	46	1					
SEC COM	47	1					
TRK MSTR	48	2					
HY VEH DR	49	15					
A.,P ST	50	3					
MESS STEW	51	6					
COOK	52	16					
SUP SGT	53	1					
SUP MAN	54	4					
MED PLT LDR	55	1					
PLT SGT	56	2					
CLNCL SPEC	57	1					
MED AID	58	10					
PHY ASST	59	1					
CLNCL SPEC	60	1					
MED AID	61	5					
TOTAL		174					

FIGURE 3-3. CUMULATIVE TEAM REQUIREMENTS, HEADQUARTERS COMPANY, ARMORED BATTALION.

FIGURE 3-4. TRANSFER MATRIX, PERSONNEL, HEADQUARTERS COMPANY, ARMORED BATTALION (CONT'D).

An entry of -1 indicates that a transfer is not possible. For example, the entry of ten at the intersection of row forty-nine and column forty-five indicates that ten minutes is required to transfer an individual from skill forty-nine (heavy-vehicle driver) to the function designated by forty-five (recovery-vehicle operator). The zeros in the primary diagonal indicate zero time is required for a task to assume its own function. Examination of the personnel transfer matrix shows a high degree of transferability for many of the essential functions.

Figure 3-5 shows the materiel requirements for forming the same essential teams, organized so that equipment requirements correspond to the unit personnel team requirements. The transfer matrix showing allowed substitution between items of equipment is at Figure 3-6. This matrix is read similarly to the personnel-transfer matrix. As an example, the command tank (row three) may assume the function of the command armored personnel carrier (column one) in ten minutes.

3. RESULTS

Using the input described above, the unit's base-case capability to reconstitute effectiveness was determined from AMORE runs at three damage levels: Case 1, 2, and 3. In Figures 3-7, the percent unit effectiveness is presented as a function of time for the three damage cases. For all three cases the unit effectiveness is limited only by personnel requirements.

Figure 3-8 lists the personnel functions and equipment which limited the company's mission capabilities. The tasks or functions listed in the first column are those required for the mission essential teams as shown in Figure 3-3. Every task required in Figure 3-3 appears in Figure 3-8; however, the order in the first column of Figure 3-8 (The more critical functions appear higher in the column.) reflects the results of detailed analysis of the unit's ability to recover effectiveness following three levels of attack. An "X" indicates the damage case where the shortages of mission-essential functions occurred, resulting in the unit's failure to achieve full capability. Critical equipment are also identified. The list of required substitutes shows those non-essential functions which substituted for critical personnel tasks during the AMORE runs.

At each level of combat damage (0, 1, 2, and 3) the unit effectiveness was examined as a function of increased levels of drug

EQUIPMENT	NO.	TOE	1	2	3	4	5
ARM PER CAR	1	1			1	1	1
PER CAR	2	4	1	2	2	2	3
TANK	3	3	1	1	2	2	3
TRUCK, 2½ TON	4	2				1	1
TRUCK, ½ TON	5	3			1	1	2
TRUCK, ½ TON	6	2					
TRUCK, ½ TON	7	1					
TRUCK, 1½ TON	8	4	1	2	2	2	3
TRUCK, 2½ TON	9	5	1	1	2	2	3
HVY REC VEH	10	2					1
LT REC VEH	11	1			1	1	1
WRECKER	12	1					
TRUCK, ½ TON	13	4		1	1	2	2
TRUCK	14	6				1	1
TRUCK FD	15	5			1	1	2
HVY VEH	16	4	1	1	1	2	2
HVY VEH A	17	5	1	2	2	3	3
TRUCK, ½ TON	18	1			1	1	1
AMBUL A	19	1					
AMBUL E	20	3					
TRUCK, 2½ TON	21	1					
TRUCK, 1½ TON	22	2					
TOTAL		61					

FIGURE 3-5. CUMULATIVE TEAM REQUIREMENTS, MATERIEL, HEADQUARTERS COMPANY, ARMORED BATTALION.

1	0	20	20	20	30	10	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	10	-1	-1
2	0	0	10	-1	20	0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	30	10	-1
3	10	20	0	-1	20	10	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	10	-1	-1
4	-1	-1	-1	0	-1	-1	0	-1	30	-1	-1	-1	30	30	20	-1	-1	-1	-1	30	-1
5	-1	-1	-1	30	0	0	0	-1	-1	-1	-1	-1	30	-1	-1	-1	-1	30	-1	-1	-1
6	-1	-1	-1	30	10	0	0	-1	-1	-1	-1	-1	30	-1	-1	-1	-1	30	-1	-1	-1
7	-1	-1	-1	30	20	10	0	-1	-1	-1	-1	-1	30	-1	-1	-1	-1	30	-1	-1	-1
8	-1	-1	-1	-1	30	-1	-1	0	10	-1	-1	-1	20	30	30	-1	-1	30	-1	-1	30
9	-1	-1	-1	30	30	-1	-1	10	0	-1	-1	-1	20	30	20	-1	-1	30	-1	-1	30
10	-1	-1	-1	-1	-1	-1	-1	-1	0	0	10	10	-1	-1	-1	-1	-1	-1	-1	-1	-1
11	-1	-1	-1	-1	-1	-1	-1	-1	20	0	30	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
12	-1	-1	-1	-1	-1	-1	-1	10	20	-1	10	0	20	-1	-1	-1	-1	-1	-1	-1	-1
13	-1	-1	-1	-1	10	10	10	10	-1	-1	-1	-1	0	-1	-1	-1	-1	10	-1	-1	-1
14	-1	-1	-1	10	30	30	30	20	-1	-1	-1	-1	30	0	20	-1	-1	20	-1	-1	30
15	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	20	-1	20	-1	-1	-1	40
16	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	20	20	-1	-1	-1	-1
17	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	20	-1	-1	0	20	-1	-1	-1	-1
18	-1	-1	-1	-1	30	30	30	-1	-1	-1	-1	-1	30	-1	-1	-1	0	-1	-1	-1	-1
19	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	-1	20	-1
20	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	10	0	-1	-1	-1
21	-1	-1	-1	30	-1	-1	-1	-1	30	-1	-1	-1	-1	-1	-1	-1	10	-1	-1	0	0
22	-1	-1	-1	-1	30	30	30	30	-1	-1	-1	-1	-1	30	30	-1	-1	10	-1	-1	10
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

FIGURE 3-6. TRANSFER MATRIX FOR MATERIEL, HEADQUARTERS COMPANY, ARMORED BATTALION.

HEADQUARTERS COMPANY, ARMORED BATTALION

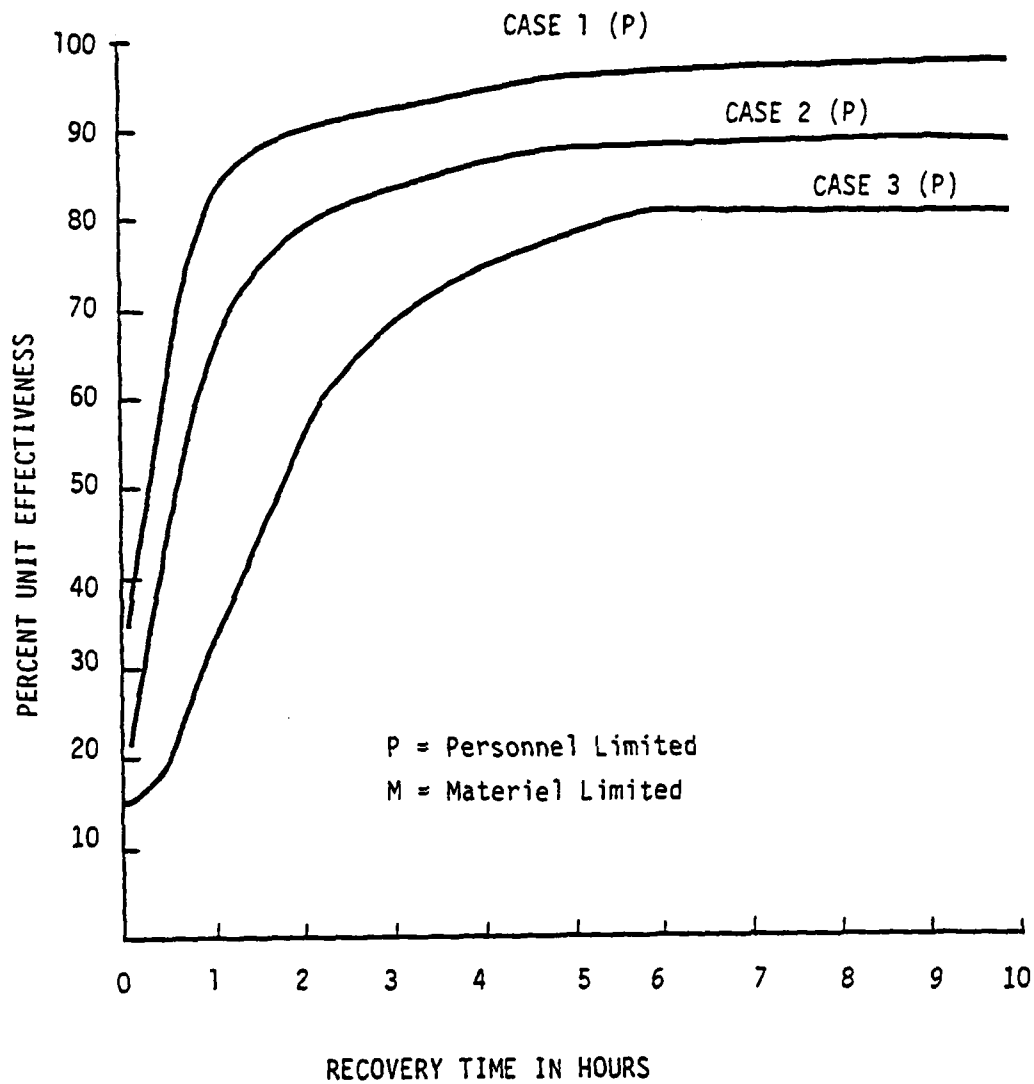


FIGURE 3-7. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE AT THREE LEVELS, HEADQUARTERS COMPANY, ARMORED BATTALION.

MISSION ESSENTIAL PERSONNEL		DAMAGE			
		CASE			
TASK	NO.	0	1	2	3
S4	5		X	X	X
S1	3		X	X	
INTEL ANL	22			X	X
COMPANY COM	29		X		X
ASST OP SGT	11		X	X	
C-E ST OF	6			X	X
INTEL/OP SGT	10			X	X
COM CHIEF	25			X	X
S3 AIR	9				X
CO	1				
XO	2				
S2	4				
RTO	17				
COMR	23				
RATT OP	26				X
SWBD/OP MS CLK	27				
FLD CE MEC	28				
TRK VEH MEC	37				
OP ASST	15				
PEP CAR DR	16				
TANK DR	24				

REQUIRED SUBSTITUTES		DAMAGE			
		CASE			
TASK	NO.	0	1	2	3
CSM	8		X	X	X
XO	30		X		X

CRITICAL EQUIPMENT	
ARM PER CAR	1
PER CAR	2
TANK	3

FIGURE 3-8. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT FOR VARIOUS CASES OF COMBAT DAMAGE, HEADQUARTERS COMPANY, ARMORED BATTALION.

abuse. The incidence of drug abuse follows directly from the key assumption that only personnel less than twenty-five years old are susceptible. AMORE runs were repeated for assumed drug-abuse levels of 10%, 20%, 30%, and 40%.

Figure 3-9 and 3-10 show the percent unit effectiveness remaining in headquarters company at the four levels of drug abuse for each combat damage case. The levels of drug abuse are indicated both as the percent of those susceptible to abusing drugs (less than twenty-five years of age) and as the percent of the unit population. Thus, twenty percent of those susceptible to drugs equates to ten percent of the total unit. The dashed line indicates the level of unit effectiveness limited by materiel shortages. Drug abuse impacts significantly only at damage cases two and three at the forty percent drug-abuse levels.

Figures 3-11 through 3-14 identify critical personnel and required substitutes at each level of drug abuse for the four damage cases (0, 1, 2, and 3). No functions were identified as critical at damage case 0, as the unit was able to reconstitute one-hundred percent of its essential teams at all drug levels. The XO and CSM were required to substitute, however, for mission essential personnel.

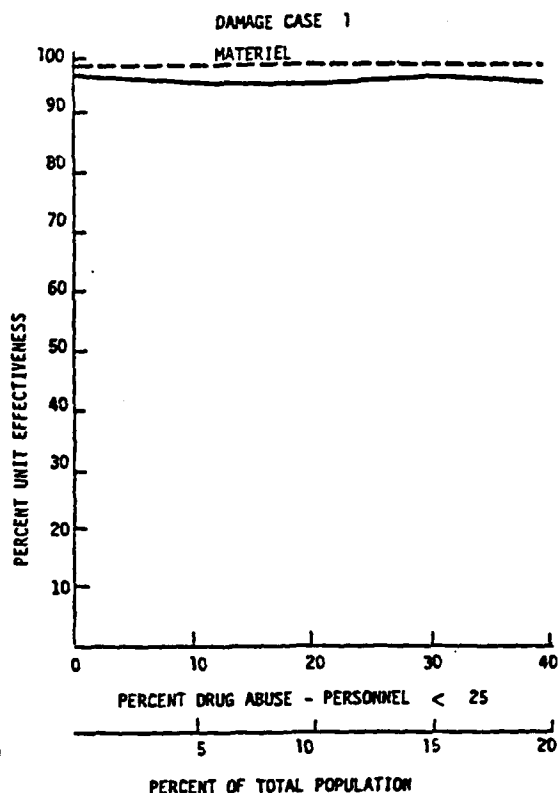
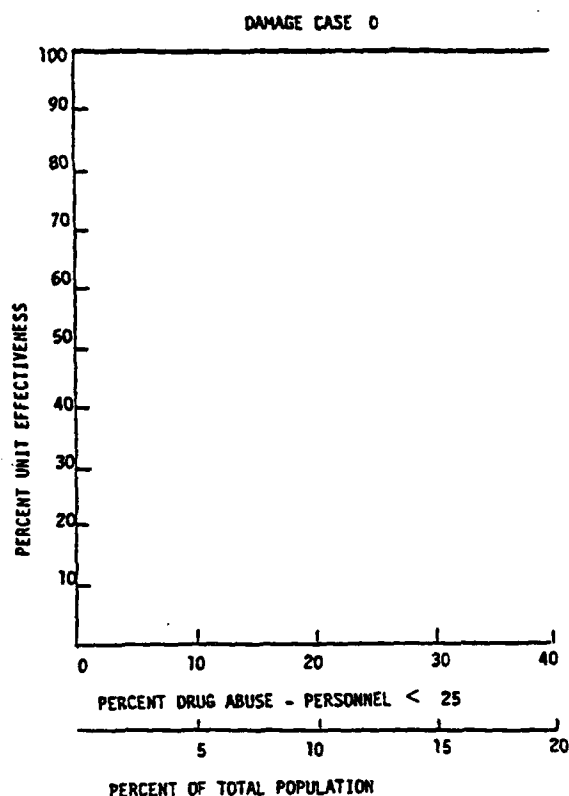


FIGURE 3-9. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE (CASES 0 AND 1) AND VARIOUS LEVELS OF DRUG USE, HEADQUARTERS COMPANY, ARMORED BATTALION.

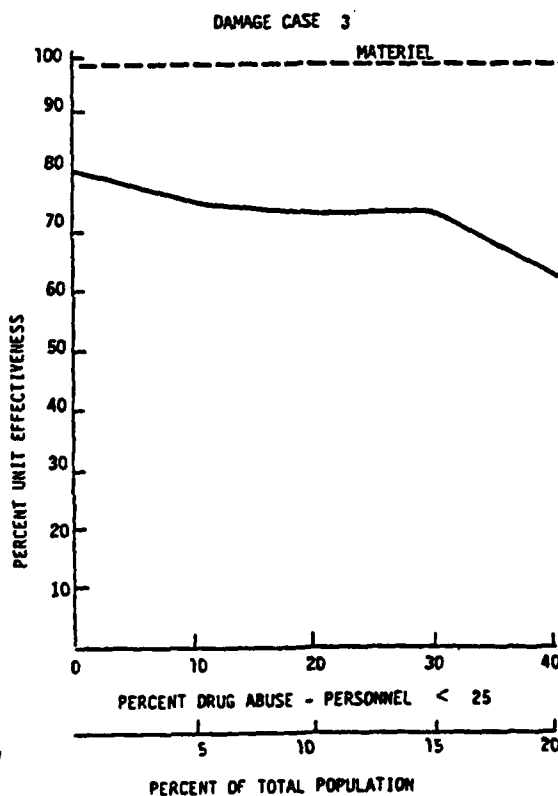
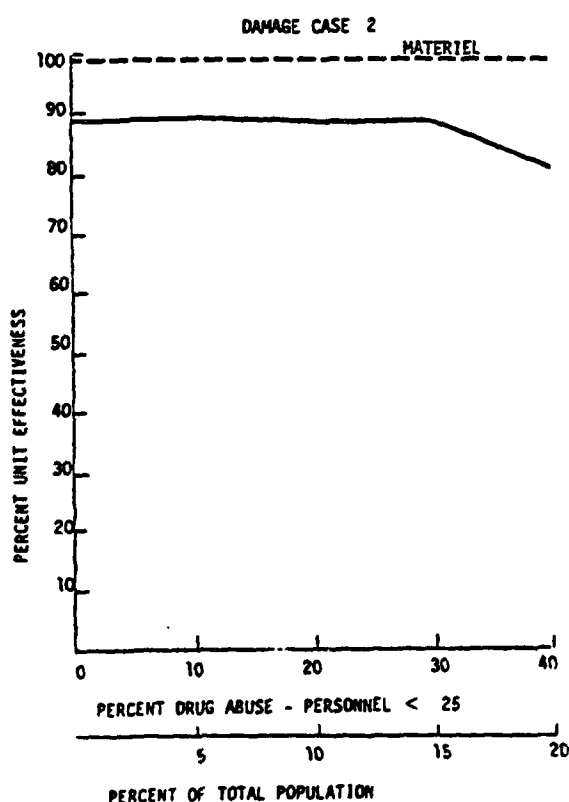


FIGURE 3-10. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE (CASES 2 AND 3) AND VARIOUS LEVELS OF DRUG USE, HEADQUARTERS COMPANY, ARMORED BATTALION.

DAMAGE CASE 0

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG LEVEL				
TASK	NO.	0	.1	.2	.3	.4
S4	5					
S1	3					
INTEL ANL	22					
COMPANY COM	29					
ASST OP SGT	11					
C-E ST OF	6					
INTEL/OP SGT	10					
COM CHIEF	25					
S3 AIR	9					
CO	1					
XO	2					
S2	4					
RTO	17					
COMR	23					
RATT OP	26					
SWBD/OP MS CLK	27					
FLD CE MEC	28					
TRK VEH MEC	37					
OP ASST	15					
PER CAR DR	16					
TANK DR	24					

REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS				
TASK	NO.	0	.1	.2	.3	.4
CSM	8					
XO	30					

CRITICAL EQUIPMENT	
ARM PER CAR	
PER CAR	
TANK	

FIGURE 3-11. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE (CASE 0), HEADQUARTERS COMPANY, ARMORED BATTALION.

DAMAGE CASE 1

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG LEVEL				
TASK	NO.	0	.1	.2	.3	.4
S4	5	X				
S1	3	X				
INTELL ANL	22			X	X	
COMPANY COM	29	X				
ASST OP SGT	11	X				
C-E ST OF	6					
INTEL/OP SGT	10		X			
COM CHIEF	25				X	
S3 AIR	9					
CO	1					
XO	2					
S2	4					
RTO	17					X
COMR	23					
RATT OP	26					
SWBD/OP MS CLK	27					X
FLD CE MEC	28					
TRK VEH MEC	37					
OP ASST	15					
PER CAR DR	16					
TANK DR	24					

REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS				
TASK	NO.	0	.1	.2	.3	.4
CSM	8	X	X	X	X	X
XO	30	X	X	X	X	X

CRITICAL EQUIPMENT	
ARM PER CAR	1
PER CAR	2
TANK	3

FIGURE 3-12. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE (CASE 1), HEADQUARTERS COMPANY, ARMORED BATTALION.

DAMAGE CASE 2

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG LEVELS				
TASK	NO.	0	.1	.2	.3	.4
S4	5	X				
S1	3	X				
INTEL ANL	22	X				
COMPANY COM	29			X	X	X
ASST OP SGT	11	X				
C/E ST OF	6	X				
INTEL/OP SGT	10	X				
COM CHIEF	25	X				
S3 AIR	9				X	
CO	1					
XO	2					
S2	4					
RTO	17				X	X
COMR	23					
RATT OP	26					
SWBD/OP MS CLK	27			X		X
FLD CE MEC	28					
TRK VEH MEC	37				X	X
OP ASST	15					
PER CAR DR	16					
TANK DR	24					

REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS				
TASK	NO.	0	.1	.2	.3	.4
CSM	8	X	X		X	X
XO	30	X	X	X	X	X

CRITICAL EQUIPMENT	
ARM PER CAR	1
PER CAR	2
TANK	3

FIGURE 3-13. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE (CASE 2), HEADQUARTERS COMPANY, ARMORED BATTALION.

DAMAGE CASE 3

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG LEVEL				
TASK	NO.	0	.1	.2	.3	.4
S4	5	X				
S1	3		X	X	X	X
INTEL ANL	22	X				
COMPANY COM	29	X				
ASST OP SGT	11		X			X
C-E ST OF	6	X				
INTEL OP	10	X				
COM CHIEF	25	X				
S3 AIR	9	X				
CO	1					X
XO	2			X		
S2	4			X		
RTO	17					X
COMR	23					X
RATT OP	26	X				
SWBD/OP MS CLK	27					X
FLD CE MEC	28					X
TRK VEH MEC	37					X
OP ASST	15					
PER CAR DR	16					
TANK DR	24					

REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS				
TASK	NO.	0	.1	.2	.3	.4
CSM	8	X	X	X	X	X
XO	30	X	X	X	X	X

CRITICAL EQUIPMENT	
ARM PER CAR	1
PER CAR	2
TANK	3

FIGURE 3-14. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE (CASE 3), HEADQUARTERS COMPANY, ARMORED BATTALION.

SECTION III COMBAT SUPPORT COMPANY, ARMORED BATTALION

1. GENERAL

The organization of the combat support company is shown at Figure 3-15. For the mission assumed in this analysis, the combat support company must provide indirect fire support, reconnaissance and air defense for the battalion and attached units. The personnel tasks for the combat support company are listed in Table 3-3 along with probabilities that individuals assigned to these MOSs are less than twenty-five years of age.

2. TEAMS AND TRANSFER MATRICES

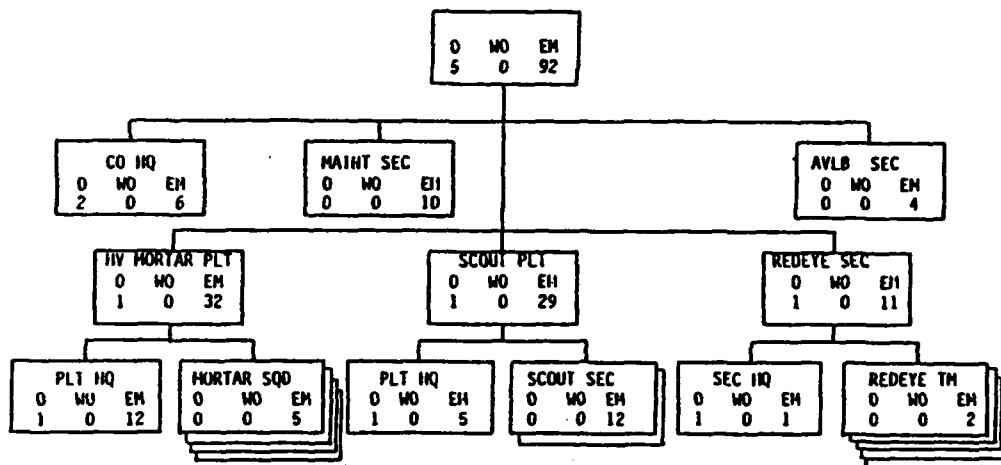
Mission essential teams were structured around the combat elements of the scout platoon, mortar platoon and redeye section, and are shown in Figure 3-16. The first three personnel teams each require an additional scout squad. Air defense and indirect fire support are added, beginning with the fourth team. Additional teams add elements in these three areas; the nineteen teams comprise a complete scout platoon, a heavy mortar platoon and a redeye section. The personnel transfer matrix, shown in Figure 3-17, is similar to the HHC matrix described in Section II. The clustering of transferability around the diagonal of the C/S company matrix indicates a high degree of transferability within sections but little between sections. The materiel team requirements and the transfer matrix are shown in Figures 3-18 and 3-19. The materiel teams are built to match the personnel teams in Figure 3-16.

3. RESULTS

AMORE runs were made for damage cases 1, 2, and 3 using the above input to establish a base case. No drug-abuse degradation was assumed at this point. The percent unit effectiveness as a function of time is shown for the three damage cases in Figure 3-20. Unit effectiveness was limited only by personnel casualties in all cases. Critical personnel the required substitutes for these functions, and the critical equipment, identified from these runs, are shown in Figure 3-21.

The AMORE runs were repeated, assuming drug usage levels of 10%, 20%, 30%, and 40% for damage cases 0, 1, 2, and 3. The resultant

unit effectiveness is shown at Figure 3-22 for damage cases zero and one and at Figures 3-23 for damage cases two and three, respectively. Each curve shows the reconstituted unit effectiveness at each drug-abuse level. Two drug-usage scales are shown. The top scale reflects the percentage of those persons less than twenty-five who are assumed to be drug abusers. The bottom scale relates this percentage to the total unit population. The dashed line indicates the limitation of unit effectiveness falls off sharply with increased drug usage for most damage levels, particularly at damage case one. The mission-limiting personnel functions and required substitutes for the different levels of drug abuse are shown for each damage case at Figures 3-24 through 3-27.



COMBAT MISSION

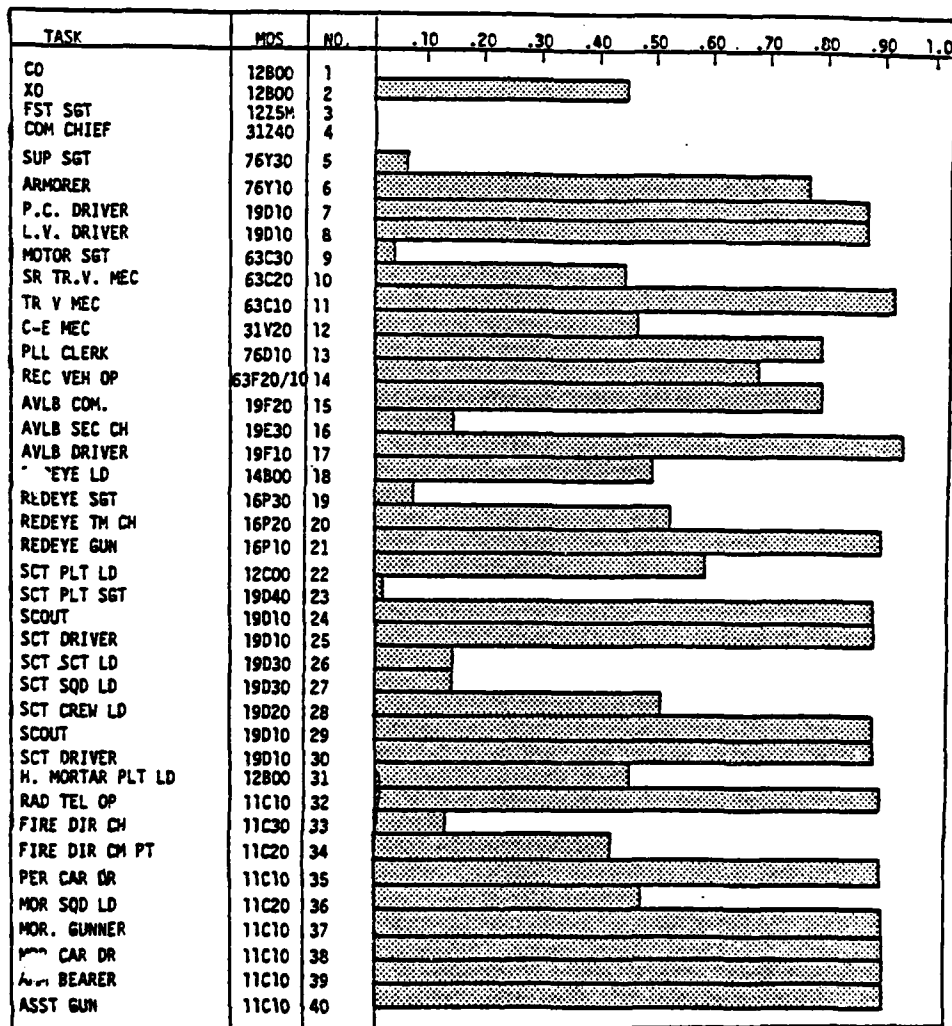
To provide reconnaissance, indirect fire support, and limited air defense for the tank battalion.

ASSUMED MISSION FOR ANALYSIS

Provide indirect fire support and reconnaissance for the battalion and attached units.

FIGURE 3-15. COMBAT SUPPORT COMPANY, ARMORED BATTALION,
TOE 17-39H0-C15.

TABLE 3-3. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE. COMBAT SUPPORT COMPANY, ARMORED BATTALION.



TASK	NO	TCE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
CO	1	1										1	1	1	1	1	1	1	1	1	1
XO	2	1																			
FST SGT	3	1																			
COM CH	4	1																			
SUP SGT	5	1																			
ARMORER	6	1																			
PC DRV	7	1																			
LV DRV	8	1																			
MOTOR SGT	9	1																			
SR TR V MEC	10	1																			
TR V MEC	11	4																			
E-E MEC	12	1																			
PLL CLK	13	1																			
REC VEH OP	14	2																			
AVLB COM	15	1																			
AVLB SEC CH	16	1																			
AVLB DRV	17	2																			
REDEYE LD	18	1																		1	1
REDEYE SGT	19	1										1	1	1	1	1	1	1	1	1	1
REDEYE TM CH	20	5			1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3	3
REDEYE GUN	21	5			1	1	1	1	2	2	3	3	3	3	4	4	4	4	4	5	5
SCT PLT LD	22	1													1	1	1	1	1	1	1
SCT PLT SGT	23	1																		1	1
SCOUT	24	2													1	1	1	1	2	2	2
SCT DRV	25	2													1	1	1	1	2	2	2
SCT SCT LD	26	2								1	1	1	1	1	1	1	2	2	2	2	2
SCT SOD LD	27	2			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
SCT CREW LD	28	4	1	2	2	2	2	3	3	3	3	4	4	4	4	4	4	4	4	4	4
SCOUT	29	8	1	2	3	3	3	3	4	4	5	5	6	6	6	6	7	7	7	7	8
SCT DRV	30	8	1	2	3	3	3	3	4	4	5	5	6	6	6	6	7	7	7	7	8
H MORTAR PLT LD	31	1												1	1	1	1	1	1	1	1
RAD TEL OP	32	2																			
FIRE DIR CH	33	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
FIRE DIR COM PT	34	2				1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2
PER CAR DRV	35	1																			
MOR SOD LD	36	4				1	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3
MOR GUNNER	37	4				1	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3
MOR CAR DRV	38	4				1	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3
AMM BEARER	39	4				1	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3
ASST GUN	40	4				1	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3
TOTAL		91																			

FIGURE 3-16. CUMULATIVE TEAM REQUIREMENTS, PERSONNEL COMBAT SUPPORT COMPANY, ARMORED BATTALION.

[illegible]

FIGURE 3-17. TRANSFER MATRIX, PERSONNEL, COMBAT SUPPORT COMPANY, ARMORED BATTALION.

EQUIPMENT	NO	TOE	TEAMS																		
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
HOT TANK	1	1																			
TRUCK, 2½	2	1																			
ARM PEP CAR	3	1																			
MOTOR TRUCK	4	1																			
TRUCK, 2½	5	1																			
REC VEH	6	1																			
AVLB	7	2																			
REDEYE TR	8	1																			
TRUCK	9	5																			
SCT ARMOR C	10	1																			
ARM PER CAR	11	1																			
ARM PER CAR	12	8																			
M MORTAR TR	13	1																			
ARM PERC FD	14	1																			
ARM PERC CAR	15	4																			
TOTAL		30																			

FIGURE 3-18. CUMULATIVE TEAM REQUIREMENTS, MATERIEL, COMBAT SUPPORT COMPANY, ARMORED BATTALION.

1	0	20	10	-1	-1	-1	-1	0	20	-1	-1	-1	0	-1	-1
2	30	0	30	20	20	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
3	10	-1	0	20	-1	-1	-1	-1	-1	30	0	30	-1	-1	-1
4	30	10	-1	0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
5	-1	10	-1	20	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
6	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1
7	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1
8	20	-1	-1	-1	-1	-1	-1	0	20	-1	-1	-1	0	-1	-1
9	30	-1	-1	-1	-1	-1	-1	20	0	-1	-1	-1	-1	-1	-1
10	-1	-1	30	-1	-1	-1	-1	-1	-1	0	20	20	-1	-1	-1
11	-1	-1	30	-1	-1	-1	-1	-1	-1	20	0	20	-1	-1	-1
12	-1	-1	30	-1	30	-1	-1	-1	-1	20	20	0	-1	-1	-1
13	20	-1	-1	-1	-1	-1	-1	20	30	-1	-1	-1	0	-1	-1
14	20	30	20	30	30	-1	-1	30	-1	30	0	20	0	0	20
15	-1	-1	30	-1	-1	-1	-1	-1	-1	30	30	20	30	-1	0
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

FIGURE 3-19. TRANSFER MATRIX, MATERIEL, COMBAT SUPPORT COMPANY, ARMORED BATTALION.

COMBAT SUPPORT COMPANY, ARMORED BATTALION

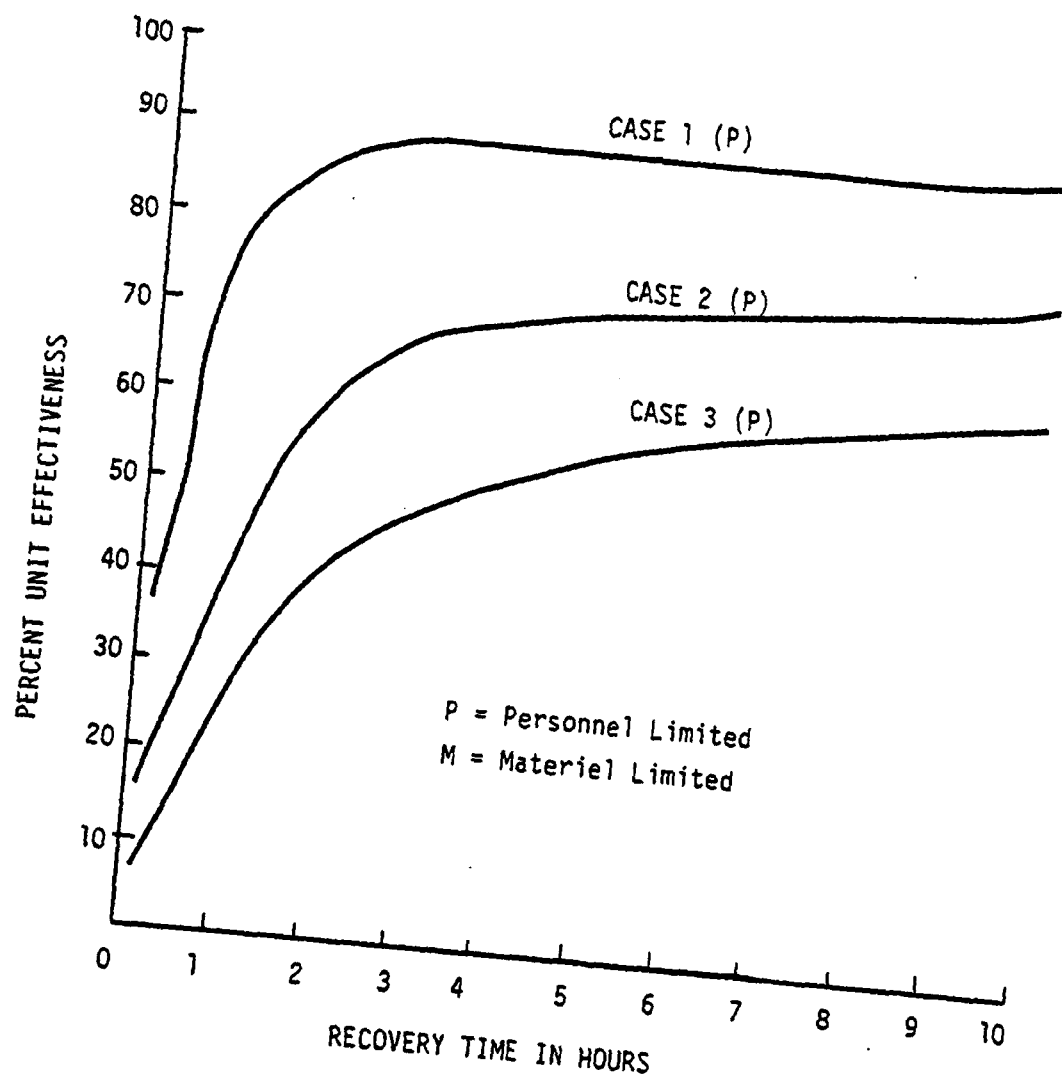


FIGURE 3-20. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE AT THREE LEVELS
COMBAT SUPPORT COMPANY, ARMORED BATTALION.

MISSION ESSENTIAL PERSONNEL		DAMAGE			
		CASE			
TASK	NO.	0	1	2	3
SCOUT	29		X	X	X
SCOUT	24		X	X	X
SCT DR	25		X	X	X
SCT DR	30			X	X
SCT PLT LD	22			X	X
MOR GUNR	37				X
MOR SQD LD	36			X	
SCT CREW LD	28				X
AMM BEAR	39				X
CO	1				X
SCT SQD LD	26				X
ASST GUNR	40				
REDY GUNR	21				
SCT PLT LDR	23				
MOR CAR DR	38				
REDY TM CH	20				
SCT SQD LD	27				
FIRE DIR CH	33				
FIRE DIR CMPT	34				
REDY LD	18				
REDY SGT	19				
H MOR PLT LD	31				

REQUIRED SUBSTITUTES		DAMAGE			
		CASE			
TASK	NO.	0	1	2	3
XO	2		X	X	X
FST SGT	3		X		X
RAD TEL OP	32			X	X
PER DR	35			X	X

CRITICAL EQUIPMENT	
TRUCK	9
SCT ARM PER CAR	10
ARM PER CAR	11
ARM PER CAR	12
ARM PER CAR	14
ARM PER CAR	15

FIGURE 3-21. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF COMBAT DAMAGE, COMBAT SUPPORT COMPANY, ARMORED BATTALION.

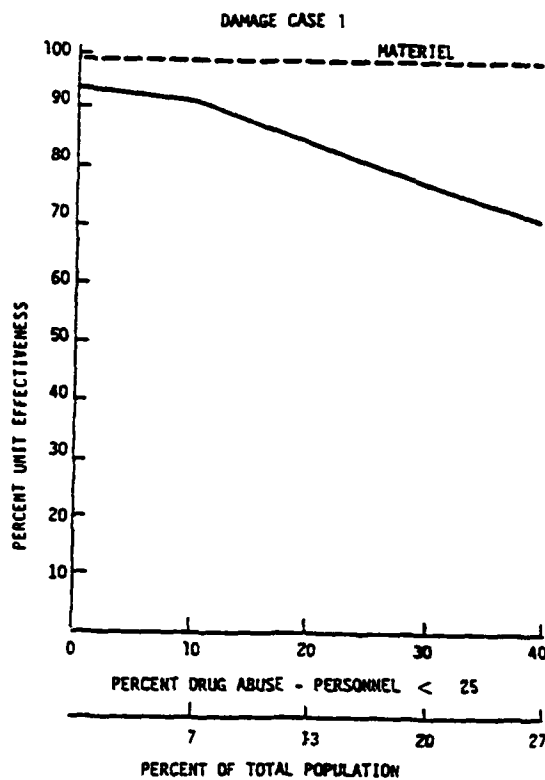
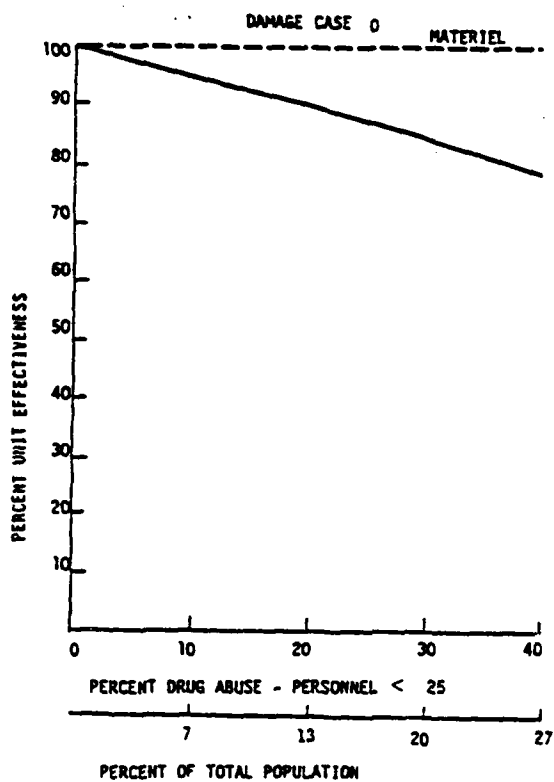


FIGURE 3-22. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE (CASES 0 AND 1) AND VARIOUS LEVELS OF DRUG USE, COMBAT SUPPORT COMPANY, ARMORED BATTALION.

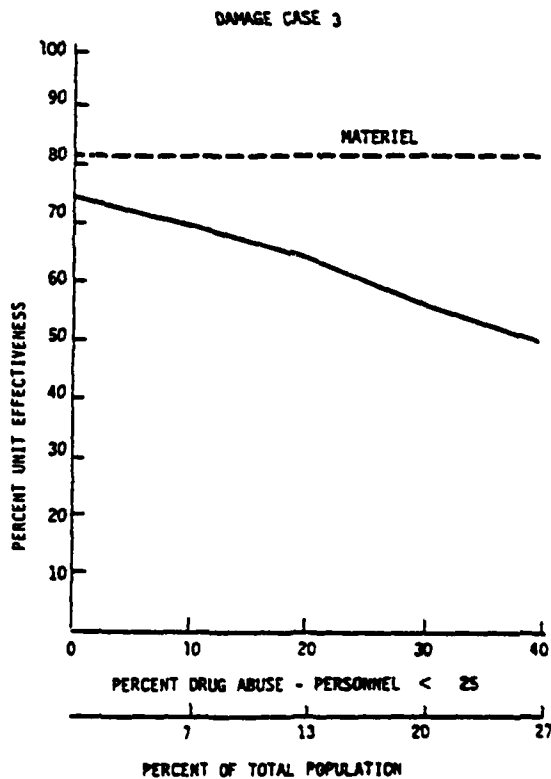
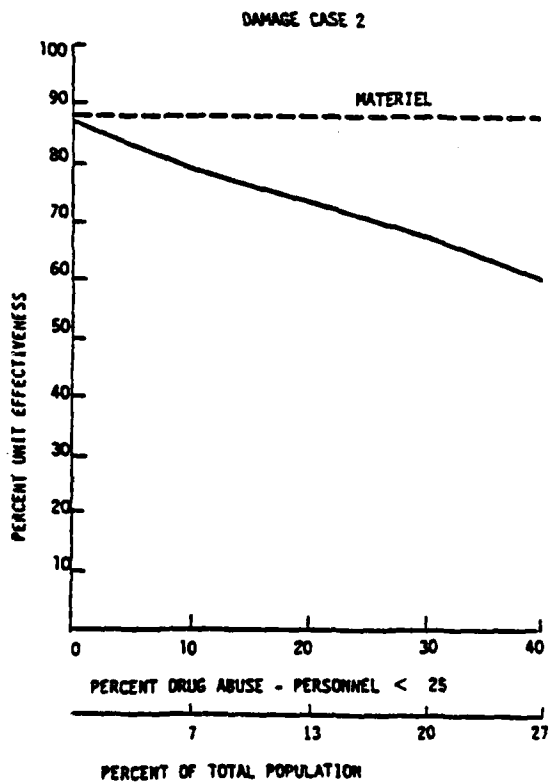


FIGURE 3-23. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE (CASES 2 AND 3) AND VARIOUS LEVELS OF DRUG USE, COMBAT SUPPORT COMPANY, ARMORED BATTALION.

DAMAGE CASE 0

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG LEVEL				
TASK	NO.	.0	.1	.2	.3	.4
SCOUT	29			X	X	X
SCOUT HQ SEC	24		X	X	X	X
SCT DR HQ SEC	25		X	X	X	X
SCT DR	30			X	X	X
SCT PLT LD	22					
MOR GUNR	37				X	X
MOR SQD LD	36					
SCT CREW LD	28					X
AMM BEAR	39					X
CO	1					
SCT SQD LD	26					
ASST GUNR	40					X
REDY GUNR	21					
SCT PLT SGT	23					
MOR CAR DR	38					
REDY TM CH	20					
SCT SQD LD	27					
FIRE DIR CH	33					
FIRE DIR CMPT	34					
REDY LD	18					
REDY SGT	19					
H MOR PLT LD	31					

REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS				
TASK	NO.	.0	.1	.2	.3	.4
XO	2			X	X	X
FST SGT	3			X	X	X
RAD TEL OP	32			X	X	X
PER DR	35				X	X

CRITICAL EQUIPMENT	
TRUCK	9
SCT ARM PER CAR	10
ARM PER CAR	11
ARM PER CAR	12
ARM PER CAR	14
ARM PER CAR	15

FIGURE 3-24. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE (CASE 0), COMBAT SUPPORT COMPANY, ARMORED BATTALION.

DAMAGE CASE 1

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG LEVEL				
TASK	NO.	.0	.1	.2	.3	.4
SCOUT	29	X	X	X	X	X
SCOUT HQ SEC	24	X	X	X	X	X
SCT DR HQ SEC	25	X	X	X	X	X
SCT DR	30		X	X	X	X
SCT PLT LD	22					
MOR GUNR	37				X	X
MOR SQD LD	36					X
SCT CREW LD	28					
AMM BEAR	39		X	X	X	X
CO	1					X
SCT SQD LD	26					
ASST GUNR	40		X	X	X	X
REDY GUNR	21			X	X	
SCT PLT SGT	23					
MOR CAR DR	38				X	X
REDY TM CH	20					
SCT SQD LD	27					
FIRE DIR CH	33					
FIRE DIR CMPT	34					
REDY LD	18					
REDY SGT	19					
H MOR PLT LD	31					

REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS				
TASK	NO.	.0	.1	.2	.3	.4
XO	2	X	X	X	X	X
FST SGT	3	X	X	X	X	X
RAD TEL OP	32		X	X	X	X
PER DR	35		X	X	X	X

CRITICAL EQUIPMENT	
TRUCK	9
SCT ARM PER CAR	10
ARM PER CAR	11
ARM PER CAR	12
ARM PER CAR	14
ARM PER CAR	15

FIGURE 3-25. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE (CASE 1), COMBAT SUPPORT COMPANY, ARMORED BATTALION.

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AN ASSESSMENT OF THE HYPOTHETICAL IMPACT OF DRUG ABUSE ON COMBA--ETC(U)

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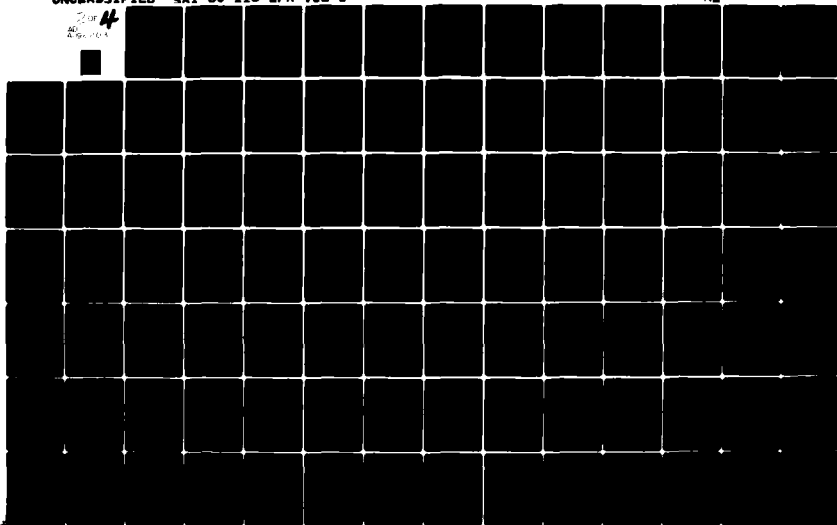
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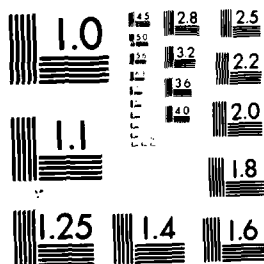


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DAMAGE CASE 2

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG LEVEL				
TASK	NO.	0	.1	.2	.3	.4
SCOUT	29	X	X	X	X	X
SCOUT	24	X	X	X	X	X
SCT DR	25	X	X	X	X	X
SCT DR	30	X	X	X	X	X
SCT PLT LD	22	X				
MOR GUNR	37			X	X	X
MOR SQD LD	36	X			X	X
SCT CREW LD	28		X	X	X	X
AMM BEAR	39		X	X	X	
CO	1		X	X		X
SCT SQD LD	26					
ASST GUNR	40			X	X	X
REDY GUNR	21			X	X	X
SCT PLT LDR	23		X			
MOR CAR DR	38				X	X
REDY TH CH	20					
SCT SQD LD	27					
FIRE DIR CH	33					
FIRE DIR CMPT	34					X
REDY LD	18					
REDY SGT	19					
H MOR PLT LD	31					

REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS				
TASK	NO.	0	.1	.2	.3	.4
XO	2	X	X	X	X	X
FST SGT	3		X	X	X	X
RAD TEL OP	32	X	X	X	X	X
PER DR	35	X	X	X	X	X

CRITICAL EQUIPMENT	
TRUCK	9
SCT ARM PER CAR	10
ARM PER CAR	11
ARM PER CAR	12
ARM PER CAR	14
ARM PER CAR	15

FIGURE 3-26. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE (CASE 2), COMBAT SUPPORT COMPANY, ARMORED BATTALION.

DAMAGE CASE 3

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG LEVEL				
TASK	NO.	0	.1	.2	.3	.4
SCOUT	29	X	X	X	X	X
SCOUT	24	X	X	X	X	X
SCT DR	25	X	X	X	X	X
SCT DR	30	X	X	X	X	X
SCT PLT LD	22	X				
MOR GUNR	37	X	X		X	X
MOR SQD LD	36					
SCT CREW LD	28	X	X	X	X	X
AMM BEAR	39	X	X	X	X	X
CO	1	X			X	X
SCT SQD LD	26	X	X			
ASST GUNR	40		X		X	X
REDY GUNR	21		X	X	X	X
SCT PLT SGT	23					
MOR CAR DR	38				X	X
REDY TH CH	20		X	X		
SCT SQD LD	27					X
FIRE DIR CH	33		X			
FIRE DIR CMPT	34			X		
REDY LD	18					
REDY SGT	19					
H MOR PLT LD	31					

REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS				
TASK	NO.	0	.1	.2	.3	.4
XO	2	X	X	X	X	X
FST SGT	3	X	X	X	X	X
RAD TEL OP	32	X	X	X	X	X
PER DR	35	X	X	X	X	X

CRITICAL EQUIPMENT	
TRUCK	9
SCT ARM PER CAR	10
ARM PER CAR	11
ARM PER CAR	12
ARM PER CAR	14
ARM PER CAR	15

FIGURE 3-27. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE (CASE 3), COMBAT SUPPORT COMPANY, ARMORED BATTALION.

SECTION IV TANK COMPANY, ARMORED BATTALION

1. GENERAL

The tank company is the main operational unit of the armored battalion and is organized as shown in Figure 3-28. A total of nineteen functions were identified for analysis and are listed in Table 3-4 along with the probabilities that these MOSs are occupied by personnel less than twenty-five years of age.

2. TEAMS AND TRANSFER MATRICES

Mission-essential teams were built around the basic combat element (tank and crew). Seventeen teams were built and are shown in Figure 3-29. These teams are structured cumulatively for AMORE analysis similarly to the teams in HHC described in Section II. Team one requires only the necessary crew to move and shoot one tank. Each additional team adds to this capability. Command and control elements are added as required. Transfers allowable between personnel functions are shown in the matrix at Figure 3-30. Equipment is assigned to each team to match the personnel requirement and is shown in Figure 3-31. Allowable transfers among materiel items are shown in the transfer matrix at Figure 3-32.

3. RESULTS

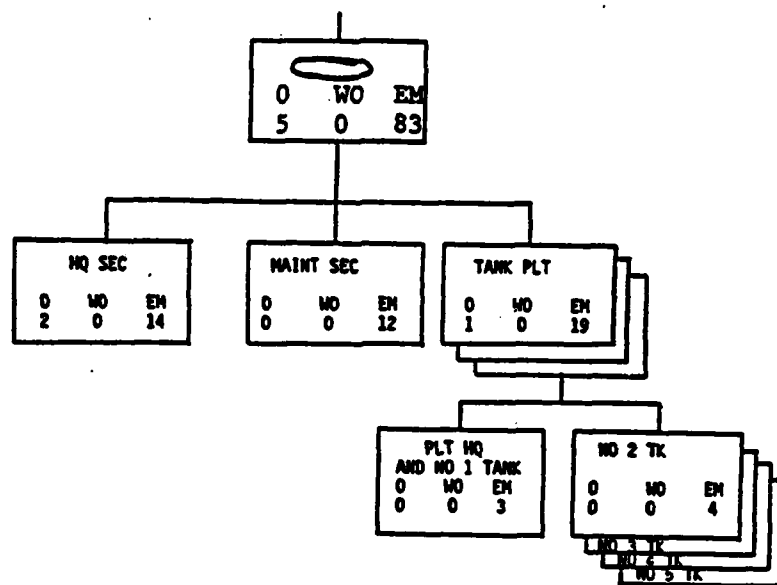
The reconstituted unit effectiveness following combat damage is shown in Figure 3-33 for the three damage cases. No degradation due to drug abuse was assumed at this point. In contrast with the other two companies in the battalion, unit effectiveness is limited by materiel requirements rather than personnel shortages. This is due primarily to the high degree of substitutability among the personnel functions as opposed to equipment. Nothing can substitute for a tank.

Critical personnel and equipment for the tank company are listed in Figure 3-34. It is significant that no personnel task was identified as critical. This is another reflection of the ease of transferability from one function to another.

The AMORE runs were repeated applying the drug-abuse levels of 10%, 20%, 30%, and 40% combined with the age probabilities for each damage case. Unit effectiveness curves from these runs are shown in

Figure 3-35 for damage case zero and case one, and in Figure 3-36 for damage cases two and three. Two drug-usage levels are shown on the X axis. The top scale reflects the percentage of those persons under twenty-five who are assumed to be drug abusers. The bottom scale relates this level to a percentage of the total unit population. The percent of unit effectiveness limited by materiel is shown by a dashed line. Examination of these curves reflects the continued domination of materiel considerations for most damage/drug-abuse combinations. The unit is relatively insensitive to drug-abuse at the zero damage case, and for any combat damage case three, the unit effectiveness is limited by materiel shortages in all cases. As in the base case, no personnel functions were identified as critical. Materiel items identified as critical are shown in Figure 3-37.

A rank-ordered listing of all critical personnel functions from an analysis of combat levels is at Table 3-6a. Additional personnel, not identified previously in Table 3-6a, who were found critical following analysis of assumed drug-abuse levels, and their probability of being less than twenty-five years of age are shown in Table 3-6b.



COMBAT MISSION

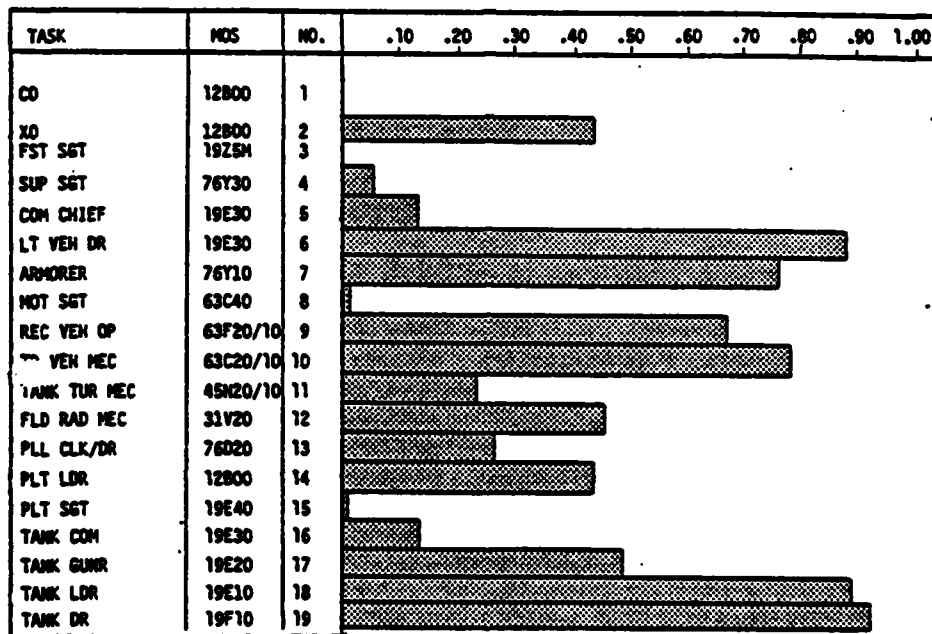
To close with and destroy enemy forces, using fire, maneuver, and shock effect.

ASSUMED MISSION FOR ANALYSIS

Defend against an armor heavy force in an intensive combat situation for a short period of time (24 hours).

FIGURE 3-28. TANK COMPANY, ARMORED BATTALION, TOE 17-37H0-C15.

TABLE 3-4. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, TANK COMPANY, ARMORED BATTALION.



TASK	NO	TOE	TEAMS																
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO	1	1										1	1	1	1	1	1	1	1
XO	2	1																	
FST SGT	3	1																	
SUP SGT	4	1																	
COM CHIEF	5	1																	
LT VEH DR	6	2																	
ARMORER	7	1																	
MOTOR SGT	8	1																	
REC VEH OP	9	2																	
TR VEH MEC	10	4																	
TANK TUR MEC	11	3																	
FLD RAD MEC	12	1																	
PLL CLERK/DR	13	1																	
PLT LD	14	3																	
PLT SET	15	3																	
TANK COM	16	11																	
TANK CUNR	17	17																	
TANK LOADER	18	17																	
TANK DR	19	17																	
TOTAL		88																	

FIGURE 3-29. CUMULATIVE TEAM REQUIREMENTS, PERSONNEL, TANK COMPANY, ARMORED BATTALION.

1	0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	10	-1	-1	-1	-1	-1
2	0	0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	10	-1	-1	-1	-1	-1
3	-1	10	0	10	-1	-1	-1	30	-1	-1	-1	-1	-1	20	10	20	30	-1	-1
4	-1	-1	-1	0	-1	-1	10	20	-1	-1	-1	-1	-1	-1	20	10	20	30	30
5	-1	-1	-1	-1	0	-1	-1	10	20	-1	-1	10	-1	-1	-1	30	20	30	30
6	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	10	10
7	-1	-1	-1	10	-1	0	0	20	30	-1	-1	-1	-1	-1	-1	-1	-1	-1	10
8	-1	30	10	20	-1	-1	-1	0	0	10	10	-1	-1	-1	20	10	20	20	20
9	-1	-1	-1	20	-1	10	-1	-1	0	10	-1	-1	-1	-1	-1	-1	-1	10	10
10	-1	-1	-1	-1	-1	10	-1	-1	10	0	20	-1	20	-1	-1	-1	-1	10	10
11	-1	-1	-1	-1	-1	-1	-1	-1	-1	10	0	10	20	-1	-1	-1	-1	10	10
12	-1	-1	-1	-1	20	0	-1	-1	-1	-1	-1	0	30	-1	-1	-1	-1	10	10
13	-1	-1	-1	20	-1	-1	-1	-1	20	-1	-1	-1	0	-1	-1	-1	10	10	10
14	20	10	10	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	20	30	30	30
15	-1	20	10	-1	30	-1	-1	-1	30	-1	-1	-1	-1	0	0	0	10	10	20
16	-1	-1	-1	-1	-1	-1	-1	-1	20	30	30	30	-1	20	10	0	0	0	10
17	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	10	0	0	0
18	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0
19	-1	-1	-1	-1	-1	10	-1	-1	10	20	20	-1	10	-1	-1	-1	0	0	0
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

FIGURE 3-30. TRANSFER MATRIX, PERSONNEL, TANK COMPANY, ARMORED BATTALION.

EQUIPMENT	NO	TOE	TEAMS																
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
CO TANK	1	1								1	1	1	1	1	1	1	1	1	1
XO TANK	2	1																	1
SUPTRUCK, 2 1/2	3	1																	
TRAILER, 1 1/2	4	1																	
TRUCK, VRC 47	5	1																	
TRUCK, VRC 46	6	1																	
ARM PER CAR	7	1																	
REC VEH	8	1																	
MAIN TR, 2 1/2	9	1																	
TRAILER, 1 1/2	10	1																	
TRUCK, 1 1/2	11	1																	
TRAILER, 1 1/2	12	1																	
PLT LD TANK	13	3					1	1	1	1	1	1	1	1	2	2	2	3	3
PLT SET TANK	14	3		1	1	1	1	1	1	1	1	1	1	2	2	2	3	3	3
TANK	15	9	1	1	2	3	3	4	5	5	6	7	8	8	8	9	9	9	9
TOTAL		27																	

FIGURE 3-31. CUMULATIVE TEAM REQUIREMENTS, MATERIEL, TANK COMPANY, ARMORED BATTALION.

1	0	0	-1	-1	-1	-1	30	-1	-1	-1	-1	-1	0	20	20
2	0	0	-1	-1	-1	-1	10	-1	-1	-1	-1	-1	0	10	10
3	-1	-1	0	-1	0	0	20	-1	30	-1	0	-1	-1	-1	-1
4	-1	-1	-1	0	-1	-1	-1	-1	10	-1	10	-1	-1	-1	-1
5	-1	-1	-1	-1	0	0	20	-1	-1	-1	0	-1	-1	-1	-1
6	-1	-1	-1	-1	10	0	20	-1	-1	-1	0	-1	-1	-1	-1
7	-1	-1	30	-1	20	10	0	-1	30	-1	10	-1	-1	-1	-1
8	-1	-1	-1	-1	-1	-1	10	0	-1	-1	-1	-1	-1	-1	-1
9	-1	-1	20	-1	-1	-1	30	-1	0	-1	10	-1	-1	-1	-1
10	-1	-1	-1	10	-1	-1	-1	-1	-1	0	-1	10	-1	-1	-1
11	-1	-1	-1	-1	0	0	20	-1	-1	-1	0	-1	-1	-1	-1
12	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1
13	10	0	-1	-1	-1	-1	20	-1	-1	-1	-1	-1	0	0	0
14	20	10	-1	-1	-1	-1	10	-1	-1	-1	-1	-1	10	0	0
15	30	20	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	20	10	0
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

FIGURE 3-32. TRANSFER MATRIX, MATERIEL, TANK COMPANY, ARMORED BATTALION.

TANK COMPANY, ARMORED BATTALION

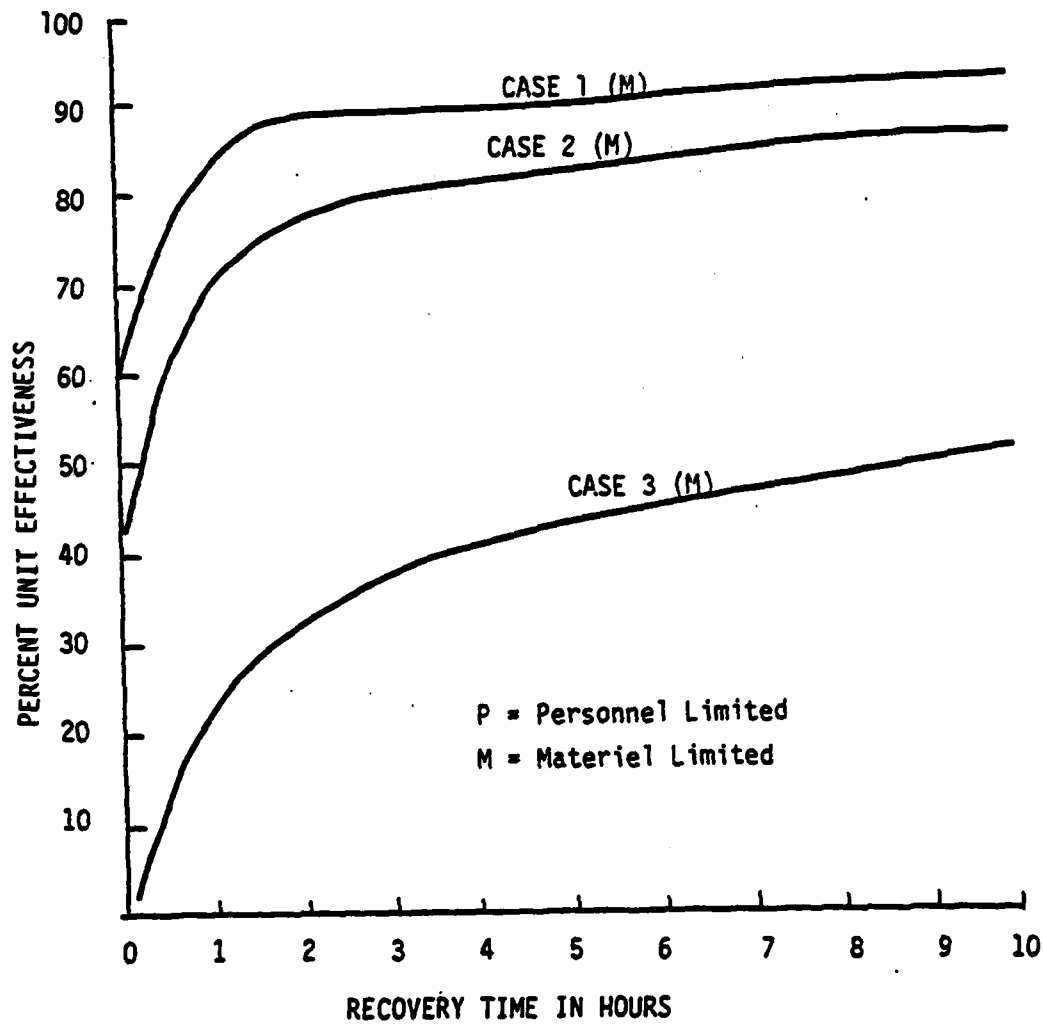


FIGURE 3-33. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE AT THREE LEVELS, TANK COMPANY, ARMORED BATTALION.

MISSION ESSENTIAL PERSONNEL*		DAMAGE CASE				
TASK	NO.	0	1	2	3	
CO	1					
PLT LD	14					
PLT SGT	15					
TANK COM	16					
TANK GUNR	17					
TANK LOAD	18					
TANK DR	19					

REQUIRED SUBSTITUTES		DAMAGE CASE				
TASK	NO.	0	1	2	3	

CRITICAL EQUIPMENT	
CO TANK	1
XD TANK	2
PLT LDR TANK	13
PLT SGT TANK	14
TANK	15

*All cases are limited by number of personnel, hence none are critical.

FIGURE 3-34. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF COMBAT DAMAGE, TANK COMPANY, ARMORED BATTALION.

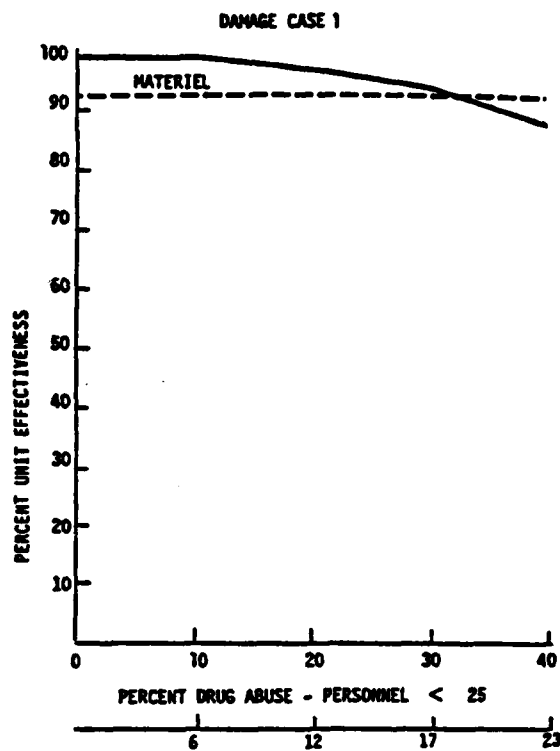
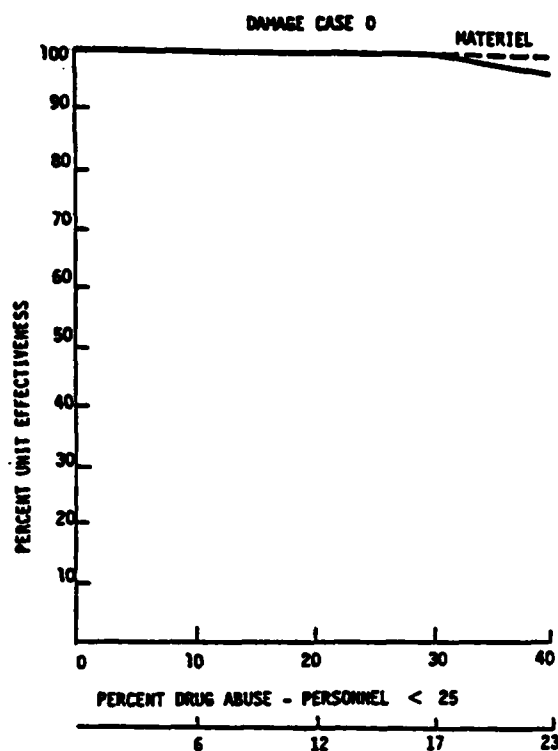


FIGURE 3-35. UNIT EFFECTIVENESS FOLLOWING COMBAT (CASE 0 and 1) AND VARIOUS LEVELS OF DRUG USE, TANK COMPANY, ARMORED BATTALION.

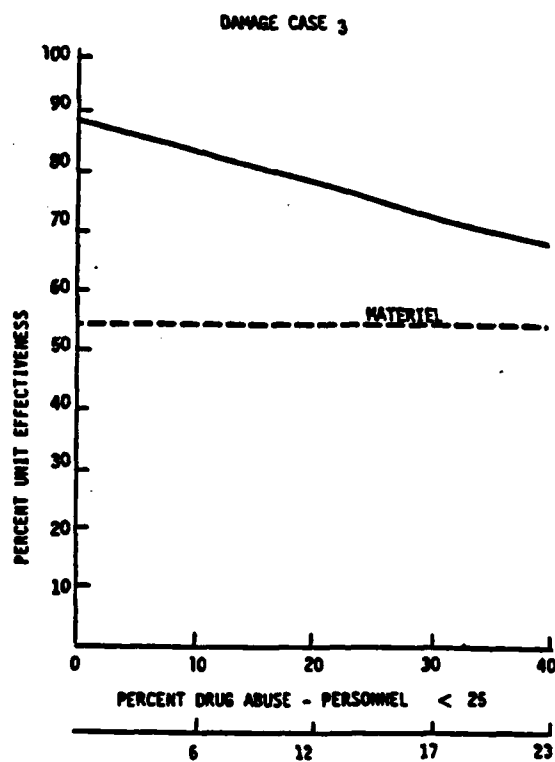
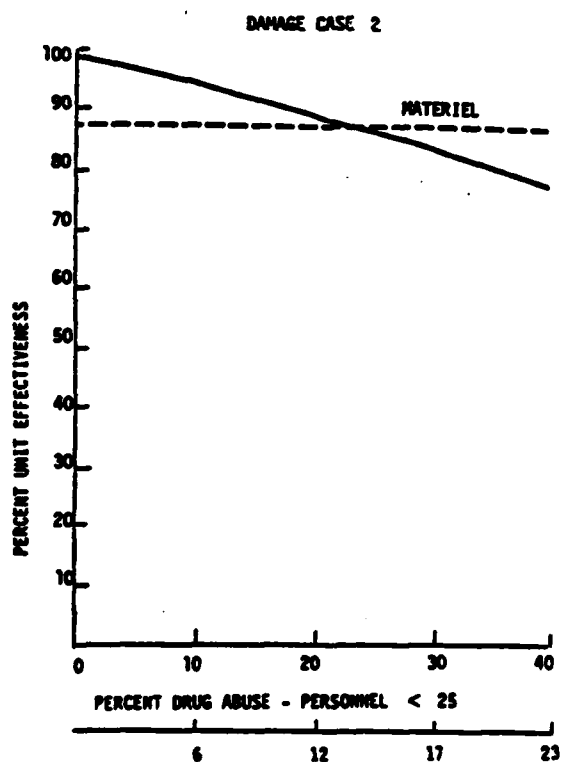


FIGURE 3-36. UNIT EFFECTIVENESS FOLLOWING COMBAT (CASE 2 AND 3) AND VARIOUS LEVELS OF DRUG USE, TANK COMPANY, ARMORED BATTALION.

*ALL DAMAGE CASES

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS DRUG LEVEL				
TASK	NO.	0	.1	.2	.3	.4
CO	1					
PLT LD	14					
PLT SGT	15					
TANK COM	16					
TANK GUNR	17					
TANK LOAD	18					
TANK DR	19					

REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS				
TASK	NO.	0	.1	.2	.3	.4

CRITICAL EQUIPMENT	
CO TANK	1
XO TANK	2
PLT LDR TANK	13
PLT SGT TANK	14
TANK	15

*All Cases are limited by number of Personnel, hence none are critical.

FIGURE 3-37. MISSION LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE, TANK COMPANY, ARMORED BATTALION (ALL CASES).

TABLE 3-6. CRITICAL PERSONNEL FROM COMBAT DAMAGE AND DRUG ABUSE

a. Personnel Critical From Combat Damage Only

HEADQUARTERS COMPANY	COMBAT SUPPORT COMPANY	TANK COMPANY
TASK	TASK	TASK
S4	SCOUT	NONE- MATERIEL LIMITED OR LIMITED BY TOTAL POPULATION
S1	SCOUT, HQ SECT	
INTEL AMAL	SCT DR, HQ SECT	
CO CDR	SCOUT DR	
ASST OP SGT	SCOUT PLT LDR	
C-E STAFF OFF	MORTAR GNR	
INTEL/OP SCT	MORTAR SQD LDR	
COMM CHIEF	SCOUT CREW LDR	
S3 AIR	AMMO BEARER	
RATT OP	CO CDR	
	SCOUT SQD LDR	

b. Additional Personnel Critical From Drug Abuse

HEADQUARTERS COMPANY	COMBAT SUPPORT COMPANY	TANK COMPANY
TASK	TASK	TASK
RTD .400	ASST MORT GNR .884	NONE- MATERIEL LIMITED OR LIMITED BY TOTAL POPULATION
SWBD OP/MES CLK .388	REDEYE GNR .882	
TRK VEN MEC .908	SCT PLT SGT .009	
CO .000	MORT CARR DR .884	
XO/S3 .000	REDEYE TEAM CHF .509	
S2 .000	SCOUT SQD LDR .129	
COMR .134	FIRE DIR CHF .114	
FLD CE MEC .458	FIRE DIR COMPUTR .454	

SECTION V SUMMARY

Unit effectiveness at various drug-abuse levels and damage cases is presented in Figure 3-38 for the three company units in the armored battalion. The curves reflect the capability of these units to form essential personnel and equipment teams as a function of drug abuse based on personnel casualties. The analysis assumed a drug-abuse susceptibility equal to the probability of being less than twenty-five years of age. Unit effectiveness of the headquarters company and the combat support company was limited in all cases by personnel shortages. The tank company on the other hand was limited by materiel in all cases except at the forty percent drug-abuse level for damage cases one and two, and at the thirty percent drug-abuse levels for damage case two. From Figure 3-38, it is apparent that the combat support company has the greatest risk of failure from drug abuse, while HHC has the least risk.

These general observations are presented in a quantitative form in Table 3-5, which gives the trend analysis of risk from functional failure of a unit due to drug abuse at various levels of combat damage. These values express a unit's tolerance to drug abuse. It is defined as the ratio of decreased unit effectiveness to increases in drug abuse. When this ratio is high the unit is very vulnerable to an increase in drug abuse. Conversely, when the ratio is low the unit can tolerate certain levels of drug abuse with less than proportionate decreases in unit effectiveness. Generally, (except for damage case three) the values for the headquarters company are quite small, indicating a high tolerance to drug abuse. Combat support company has the least tolerance to drug abuse.

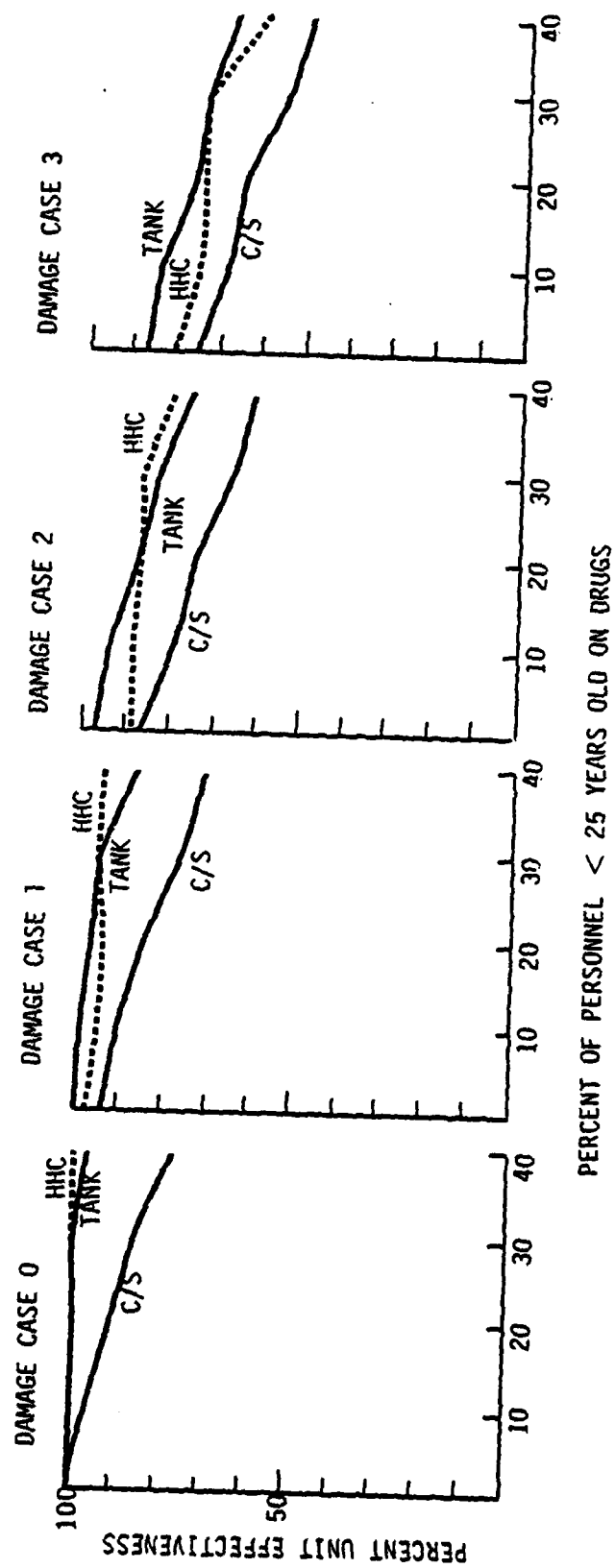


FIGURE 3-38. SUMMARY OF UNIT EFFECTIVENESS AT VARIOUS DRUG-ABUSE LEVELS AND DAMAGE CASES, ARMORED BATTALION.

TABLE 3-5. TOLERANCE RATIOS, ARMORED BATTALION.

UNIT	DAMAGE CASE			
	0	1	2	3
HEADQUARTERS COMPANY	.00	.02	.02	.40
SUPPORT COMPANY	.56	.76	.64	.64
TANK COMPANY	.06	.29	.55	.53

CHAPTER FOUR
FIELD ARTILLERY BATTALION, 155mm, SELF-PROPELLED,
ARMORED AND MECHANIZED DIVISION

SECTION I
GENERAL

The 155mm, self-propelled artillery battalion is a combat support unit which has the primary mission of delivering artillery fires in support of combat forces such as armored and infantry brigades. The battalion operates as an integrated system with three primary functions:

- Acquisition of targets,
- Command, control and communications, and
- Operation and support of artillery weapons.

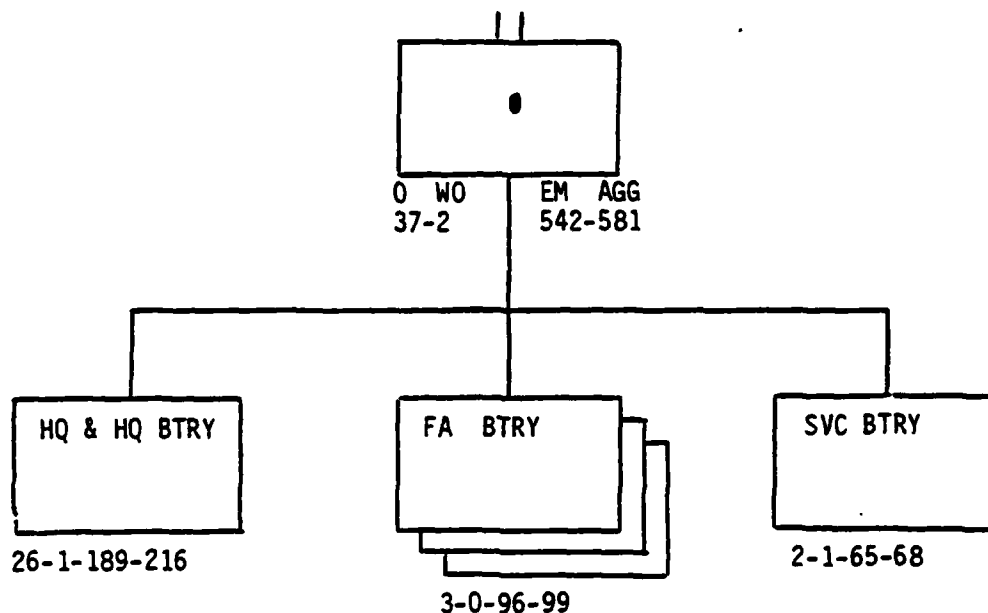
Although some redundancy exists within the battalion, each of these functions acts in series, and the failure of any one of the three links in the chain will cause the entire system to fail.

The organization of the artillery battalion is shown in Figure 4-1. The battalion has three unique units (batteries), each of which was analyzed using the methodology described in Chapter Two. These units are:

- Headquarters Battery,
- Service Battery, and the
- Firing Battery.

These three units were assumed to be operating as components of a battalion in an intense defensive operation of relatively short duration — twenty-four hours. The input data needed by the AMORE methodology was developed from this basic assumption.

Each battery unit was analyzed at four levels of combat damage: 0, 10, 20, and 30 percent personnel casualties. These levels hereafter will be referred to as damage cases 0, 1, 2, and 3, respectively. Materiel-damage levels corresponding to these personnel casualties are displayed in Table 4-1. Casualties resulting from drug abuse were considered at five levels (0, 10, 20, 30, and 40 percent)



COMBAT MISSION

TO PROVIDE FIELD ARTILLERY FIRES IN DIRECT SUPPORT OF A MANEUVER BRIGADE (ARMORED OR MECHANIZED) OR IN GENERAL SUPPORT OF THE MANEUVER FORCE.

ASSUMED MISSION FOR ANALYSIS

TO SUPPORT INTENSE DEFENSIVE OPERATIONS AGAINST ARMOR-HEAVY FORCE FOR SHORT (24 HOUR) PERIOD OF TIME.

FIGURE 4-1. FIELD ARTILLERY BATTALION, 155mm, SELF-PROPELLED ARMORED AND MECHANIZED DIVISION.

TABLE 4-1. DAMAGE COMBINATION PROBABILITIES FOR PERSONNEL AND CORRESPONDING EQUIPMENT DAMAGE FOR COMBAT DAMAGE CASES. FIELD ARTILLERY BATTALION.

UNITS			DAMAGE CASE			
			0	1	2	3
HEADQUARTERS BTRY						
	PERSONNEL		0	.10	.20	.30
	EQUIPMENT	Lt.	0	.20	.20	.30
		Mod.	0	.14	.26	.40
		Sev.	0	.02	.04	.07
SERVICE BTRY						
	PERSONNEL		0	.10	.20	.30
	EQUIPMENT	Lt.	0	.05	.10	.10
		Mod.	0	.01	.02	.03
		Sev.	0	.01	.02	.04
FIRING BTRY						
	PERSONNEL		0	.10	.20	.30
	EQUIPMENT	Lt.	0	.05	.15	.10
		Mod.	0	.03	.06	.08
		Sev.	0	.05	.10	.14

for each of the assumed damage levels. Thus, data were obtained for twenty combinations of combat damage and drug abuse.

An important input to the AMORE methodology is the composition and ordering of the essential teams. The teams must be balanced in terms of personnel and materiel, and functionally organized to support sub-tasks derived from the assumed mission of the unit. The matrix below matches the three artillery batteries to the three functional sub-systems described earlier.

	Target Acquisition	Command, Control, Communications	Weapons Support
Headquarters Battery	X	X	
Service Battery		X	X
Firing Battery		X	X

Three major considerations impacting the composition of the battery teams were (1) the mission of the force - defense, (2) the functional sub-systems, and (3) the short duration of combat - twenty-four hours.

With these assumptions in mind, the TOE was examined in detail. All unique MOSs were identified and aggregated within specific task and section groups. The aggregation improved the efficiency of the analysis, but care was exercised not to lose the resolution of the MOS skills. Teams were selected with each unit's primary combat mission and functional requirements as guides. For example, the howitzer sections comprise the primary teams in the firing battery, but fire direction and command are also essential. Ammunition supply and maintenance teams were given lower priority. Mess and supply were not considered essential in the twenty-four period immediately following an attack. In the service battery, ammunition resupply and some command and control are essential; recovery operations and maintenance come next. In the headquarters battery, fire direction (considered a component of C³) together with

communications and control are the most important functions, but the fire support teams (target acquisition) are also essential. Once again, mess, supply, and medical support are lower priorities for a short operation.

SECTION II

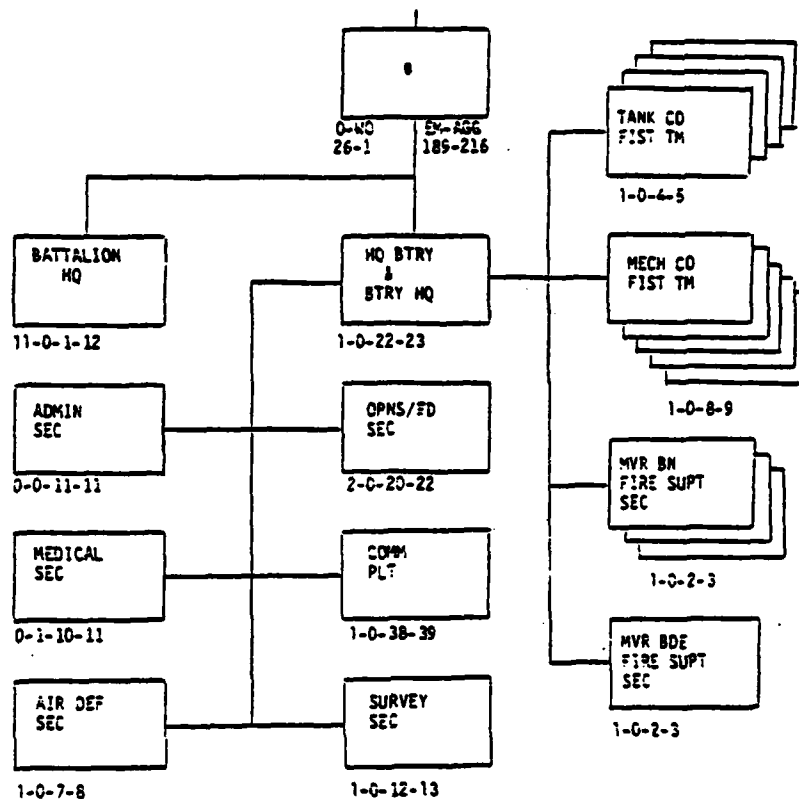
HEADQUARTERS BATTERY, FIELD ARTILLERY BATTALION

1. GENERAL

In a defensive operation the functions of C³, fire direction, and fire support coordination (including target acquisition) in the field artillery are usually more centralized than in a fast-moving offensive situation. As stated previously, these three functions are generally series operations, and the failure of any one of the three will cause the artillery system to fail. Other functions, such as survey and air defense, are also important but not as essential to mission accomplishment.

Figure 4-2 depicts the organization of the headquarters battery. The eight Fire Support Teams (FIST) and three fire support sections are responsible for target acquisition and fire support coordination. There are other systems for acquiring targets, but these teams and sections of observers are organic to artillery battalions and remain the primary means of acquiring targets and coordinating fires. The operations/fire direction section operates the TACFIRE computer system and coordinates the flow of fire requests to the firing batteries. This section can, as an option, conduct technical fire direction by computing gun settings for the guns of the firing batteries. This section is also the focal point for the battalion's command and control functions. The communications platoon provides communications personnel and equipment (both radio and wire) for establishing internal communications among the subordinate elements within the headquarters battery, and between the battery and other units both internal (other batteries) and external to the battalion. The survey section provides important, but not critical, location data of both targets and firing batteries. Survey provides an enhancement which significantly increases the accuracy and effectiveness of artillery fire. Other sections within the headquarters battery are not as essential over the short twenty-four hour operation assumed in this analysis.

Table 4-2 is a listing of the key types of personnel functions used in the analysis of headquarters battery. With few exceptions, all unique MOSs in the battery have been preserved. Where this was not feasible, the multiple MOSs are shown. The length of



COMBAT MISSION

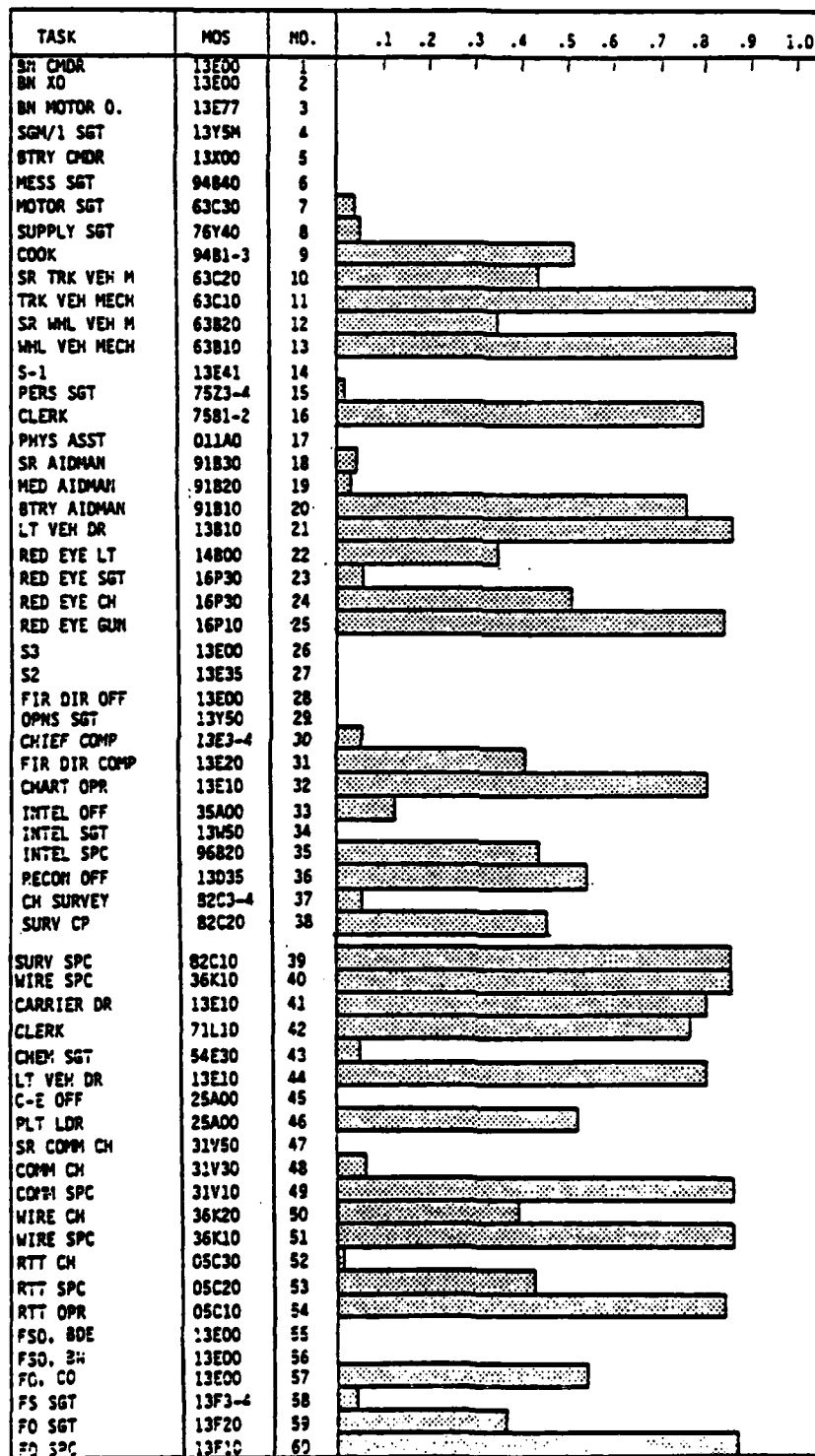
TO DIRECT AND COORDINATE OPERATIONS OF THE BATTALION AND TO PROVIDE FACILITIES FOR CONTROL BY THE COMMANDER.

ASSUMED ANALYSIS MISSION

TO PROVIDE COMMAND, CONTROL, COMMUNICATIONS, TECHNICAL FIRE DIRECTION, SURVEY, AND FIRE SUPPORT COORDINATION.

FIGURE 4-2. HEADQUARTERS AND HEADQUARTERS BATTERY, FIELD ARTILLERY BATTALION, 155mm, SELF-PROPELLED, TOE 6-366HO-C17.

TABLE 4-2. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, HEADQUARTERS BATTERY, FIELD ARTILLERY BATTALION.



TITLE	LINE	TOE	TEAMS				
			1	2	3	4	5
BN CMDR	1	1	1	1	1	1	1
BN XO	2	1					1
BN MT O	3	1			1	1	1
SGM/ 1 SGT	4	2				1	2
BTRY CO	5	1		1	1	1	1
MES SGT	6	1					
MOT SGT	7	1		1	1	1	1
SUP SGT	8	1					
COOK	9	5					
TVM	10	1			1	1	1
TVM	11	4	1	2	2	3	4
WVM	12	1				1	1
WVM	13	4	1	2	3	3	4
S 1	14	1					
PERS SG	15	3					
CLERK	16	8					
PHY AST	17	1					
SR AICM	18	1					
MED ADM	19	1					
BTRY AM	20	8					
LT V DR	21	3		1	1	2	3
RED E LT	22	1				1	1
RED E SG	23	1		1	1	1	1
RED E CH	24	3	1	1	2	2	3
RED E GN	25	3	1	2	3	3	4
S3	26	1		1	1	1	1
S4	27	1			1	1	1
F4O	28	1	1	1	1	1	1
OPS SGT	29	1				1	1
CH COMP	30	2	1	1	2	2	2
FD COMP	31	4	2	2	4	4	4
CHART	32	2	2	2	2	2	2
INTEL	33	1		1	1	1	1
INTEL	34	1		1	1	1	1
INT SPC	35	2				1	2
RECON O	36	1			1	1	1
CH SURV	37	3		1	2	3	3
SURV CP	38	4		2	4	4	4
SURV SP	39	5		2	4	5	5
WIRE SP	40	1					1
CAR DRV	41	3	1	2	3	3	3
CLERK	42	1					
SHEM SG	43	1				1	1
LT V DRV	44	2					
C - E O	45	1	1	1	1	1	1
PLT LDR	46	1					1
COMM CH	47	1		1	1	1	1
COMM CH	48	1	1	1	1	1	1
COM SPC	49	3		1	2	3	3
WIRE CH	50	4	1	2	3	3	4
WIRE SP	51	22	4	9	13	18	22
RTT CH	52	1			1	1	1
RTT SPC	53	2	1	1	1	2	2
RTT OPR	54	4	1	2	3	3	4
FSO	55	1			1	1	1
FSO	56	3	1	2	2	3	3
FO	57	9	2	4	6	8	9
FS SGT	58	13	3	6	9	12	13
FO SGT	59	15	3	6	9	12	15
SO SPC	60	40	9	18	27	36	40

FIGURE 4-3. CUMULATIVE TEAM REQUIREMENTS PERSONNEL,
HEADQUARTERS BATTERY, FIELD ARTILLERY
BATTALION.

each bar on this table represents the probability (expected value) that individuals assigned this function would be less than twenty-five years old. These results were derived from statistical data obtained from the U.S. Army's MILPERCEN. As might be expected, the probability of higher-ranking personnel being less than twenty-five years of age is quite low. Conversely, lower-ranking personnel have a higher probability of being less than twenty-five years of age. A basic assumption in this analysis is that the incidence of drug abuse is confined to personnel less than twenty-five years old. Note that the 216 personnel spaces in the headquarters battery have been reduced to sixty identifiable tasks for analysis. The line number of each task will be used as a reference for all the figures and tables throughout this section.

2. TEAMS AND TRANSFER MATRICES

Five teams were selected to represent the essential buildup of personnel and materiel for the headquarters battery. A team represents the smallest element capable of executing one or more of the sub-mission functions derived from the unit's operational mission. In the case of headquarters battery the important functions were C³ (including fire direction) and target acquisition (including fire support coordination). Each of these functions is represented on mission-essential team number one. Teams two through five are designed in a similar way, but the teams do not all have identical functional capabilities. The personnel teams are displayed in Figure 4-3. The first team calls for the battalion commander, a skeleton fire direction crew, some fire support officers and observers, and a small number of support personnel. The successive teams (shown cumulatively) add additional capabilities with emphasis on the mission sub-tasks of C³, fire direction, and fire support. As mentioned earlier, many support personnel were not considered essential to accomplishment of the stated mission for short periods of combat operations.

Figure 4-4 is the personnel-transfer matrix for the headquarters battery. The first column and the last row are the same reference numbers used to identify skills or tasks in Figures 4-2 and 4-3. Any column of numbers indicates the ability of individual skills from the horizontal entries, at the left, to substitute for the skill associated with a particular column. An entry indicates that a transfer is possible (to an accepted level of proficiency). The "-1" indicates that a transfer is not feasible. Numbers, other than "-1", are times (in minutes) for the transfers to be accomplished.

ITEM	LN.#	TOE	TEAMS				
			1	2	3	4	5
CARRIER CP	1	7	2	4	6	7	7
CARRIER	2	9	2	4	6	8	9
TRUCK, $\frac{1}{2}$ T	3	14	2	4	6	8	10
TRUCK, $1\frac{1}{2}$ T	4	12	3	6	9	11	
TRUCK, $2\frac{1}{2}$ T	5	2					
AMBULANCE	6	1					
FIELD MESS	7	2					

FIGURE 4-5. CUMULATIVE TEAM REQUIREMENTS, MATERIEL, HEAD-
QUARTERS BATTERY, FIELD ARTILLERY BATTALION.

ITEM	LN.#							
		1	2	3	4	5	6	7
CARRIER CP	1	0						
CARRIER	2	30	0					
TRUCK, $\frac{1}{2}$ T	3			0				
TRUCK, $1\frac{1}{2}$ T	4			30	0			
TRUCK, $2\frac{1}{2}$ T	5					0	0	0
AMBULANCE	6						0	
FIELD MESS	7							0

FIGURE 4-6. TRANSFER MATRIX, MATERIEL, HEADQUARTERS BATTERY,
FIELD ARTILLERY BATTALION.

For example, in Table 4-2, line number ten (or column number ten) can be identified as the Senior Track Vehicle Mechanic. We can see from Figure 4-4 that functions number eleven (Track Vehicle Mechanic), number twelve (Senior Wheel Vehicle Mechanic), and number thirteen (Wheel Vehicle Mechanic) can all transfer to number ten (Senior Track Vehicle Mechanic) with times of ten, and twenty minutes, respectively. The zeros on the primary diagonal confirm the obvious, that every function can substitute for itself with no time delay. The cluster of entries along the primary diagonal show the ready transferability of functions within assigned sections, platoons, etc. The sparseness of entries throughout the matrix is an indication of the lack of transferability, overall, throughout the battery. To some extent this sparseness is a reflection of the diverse skills and functions present in the headquarters battery of the artillery battalion.

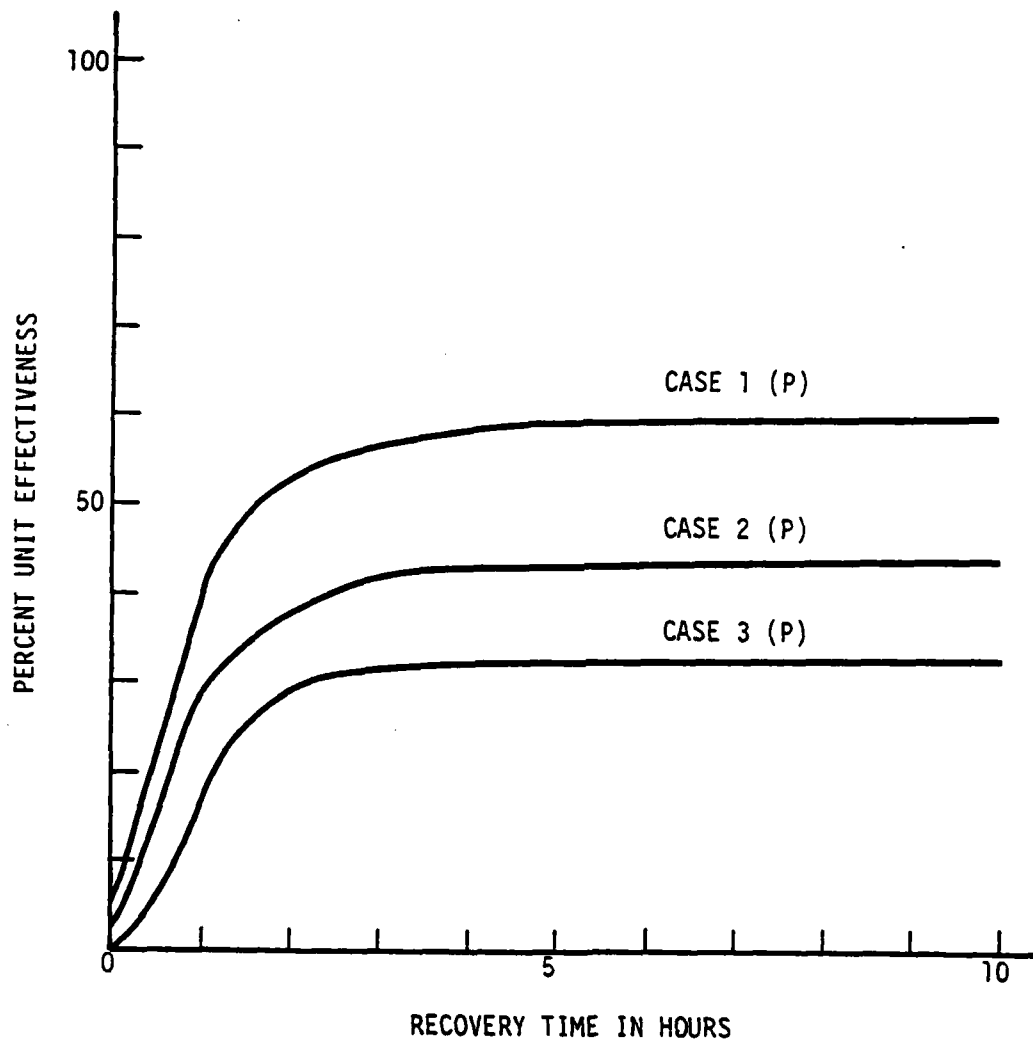
In Figure 4-5 are the cumulative team requirements for materiel. Here the number of teams must correspond to the number of personnel teams (Figure 4-3). Moreover, individual teams of personnel and materiel must be mutually supporting. Figure 4-6 is the transfer matrix for materiel. Note here, for example, that a general-purpose personnel carrier can substitute acceptably for a command-post carrier, and a 2-1/2 T truck could serve as an ambulance.

The AMORE methodology accepts as input the personnel and materiel teams, the corresponding transfer matrices, and the damage levels, all previously discussed. Personnel casualties and materiel damage are then assessed, and the program reassigns personnel and equipment to cover shortages, and reconstitutes the unit's available resources into the most effective organizations.

3. RESULTS

Figure 4-7 is a display of the effectiveness of the battery as a function of time for the three levels of combat damage (excluding the zero damage case) considered. In each case the unit's effectiveness was limited by personnel shortages. The value of these data is dependent on the accuracy or confidence in entries which make up the transfer matrix and the composition of the essential teams. The maximum effectiveness of the headquarters battery after full recovery is considerably below what might be expected for each of the combat damage cases. There are several factors that contributed to these results. First, the headquarters battery has many diverse skills not easily transferable. Second, the essential functions are linked

HEADQUARTERS BATTERY, FIELD ARTILLERY BATTALION



(P) PERSONNEL LIMITED

(M) MATERIEL LIMITED

(E) LIMITED EQUALLY BY PERSONNEL AND MATERIEL

FIGURE 4-7. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE AT THREE LEVELS, HEADQUARTERS BATTERY, FIELD ARTILLERY BATTALION.

together in series, which make the battery most vulnerable to combat losses. Finally, there are more critical functions required, and less redundancy, in the headquarters battery than in many other units. By way of example, automotive maintenance is more critical in artillery than it is perhaps in other units.

Figure 4-8 lists the personnel functions and equipment that limited the headquarters battery's mission capabilities. The tasks or functions listed in the first column were those required by the mission-essential teams (see Figure 4-3). These functions were rank-ordered, based on the results of detailed analysis of the unit's ability to recover effectiveness after three levels of attack. (See Table 4-1 for the combinations of personnel casualties and corresponding materiel damage.) An "X" indicates that shortages in this function contributed to the unit's failure to achieve full capability. These are termed critical functions. Many of the functions were short at only one or two levels. Items of critical equipment were identified in a similar way. The list of required substitutes is a list of those non-essential functions that were used to alleviate shortages of critical personnel, identified by "Xs" at the left.

Figure 4-9 and 4-10 show the effectiveness of the headquarters battery to reconstitute, following combat damage (four cases) as a function of varying levels of drug abuse. Two horizontal scales are presented. The first is the percent of drug users among those less than twenty-five years of age. The scale below is the corresponding percentage of drug users in the unit as a whole. This second scale will be different for each unit because of the variations in the age distribution in different units. The dashed line labeled "materiel" is the limit in recovery effectiveness due to combat losses of equipment at each of the four damage cases considered. It is horizontal on these displays because it is unaffected by incidence of drug abuse.

Figures 4-11 through 4-14 are similar for Figure 4-8 in format, but the critical personnel are now identified at each level of drug abuse for each of the four damage cases. The first column lists the same mission-essential personnel as in Figure 4-8. As before, the list of substitutes was identified when these personnel were required to substitute for the critical personnel previously identified in Figure 4-8. The critical equipment is unchanged from Figure 4-8, because equipment is unaffected by the incidence of drug abuse.

COMBAT DAMAGE CASES, HEADQUARTERS BTRY, FIELD ARTY BN

MISSION ESSENTIAL PERSONNEL		CBT DAM LEVEL				
TASK	NO.	0	1	2	3	
CHART OPR	32		X	X	X	
SURY SPC	39		X	X	X	
FDC COMP	31		X	X	X	
SURY C/P	38		X		X	
WIRE CH	50		X	X		
CH FD CMP	30		X	X	X	
RTT OPR	54		X		X	
CH SURV	37		X	X		
INTEL OFF	33		X	X		
WIRE SPC	51		X	X		
FIRE SUP SGT	57		X	X		
SR FD SGT	58		X	X		
TVM	11		X	X	X	
RECON OFF	36		X	X	X	
WVM	13		X		X	
FD SPC	60		X	X	X	
BN CMDR	1			X	X	
REDEYE SGT	23		X	X	X	
INTEL SGT	34		X	X		
FDO	26		X		X	
REDEYE CH	24		X			
REDEYE GUN	25		X			
FD SGT	58		X			
FSD BN	56		X	X		
SR WVM	12			X	X	
S2	27		X	X		
S3	26		X	X		
MOTOR SGT	7			X	X	
RTT SPC	53		X			
WIRE SPC	40		X			
CHM SGT	43			X		
INTEL SPC	35		X	X		
COMO SPC	49		X			
RTT CH	52		X	X		
PLT LDR	46		X			
SR COM CH	47			X	X	
OPNS SGT	29		X			
FSD BDE	55			X		
CARRIER DR	41		X		X	
BTRY CO	5					
TVM	10					
BN MTR O	3					
LT VEH DR	21					
REDEYE O	22					

REQUIRED SUBSTITUTES		CBT DAM LEVEL				
TASK	NO.	0	1	2	3	
BN XO	2		X	X	X	
LT VEH DR	44		X			
COMM CH	48		X	X	X	

CRITICAL EQUIPMENT
CARRIER, CMD POST
CARRIER, PERSONNEL
TRUCK, CARGO 1 & 2

FIGURE 4-8. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT FOR VARIOUS CASES OF COMBAT DAMAGE, HEADQUARTERS BATTERY, FIELD ARTILLERY BATTALION.

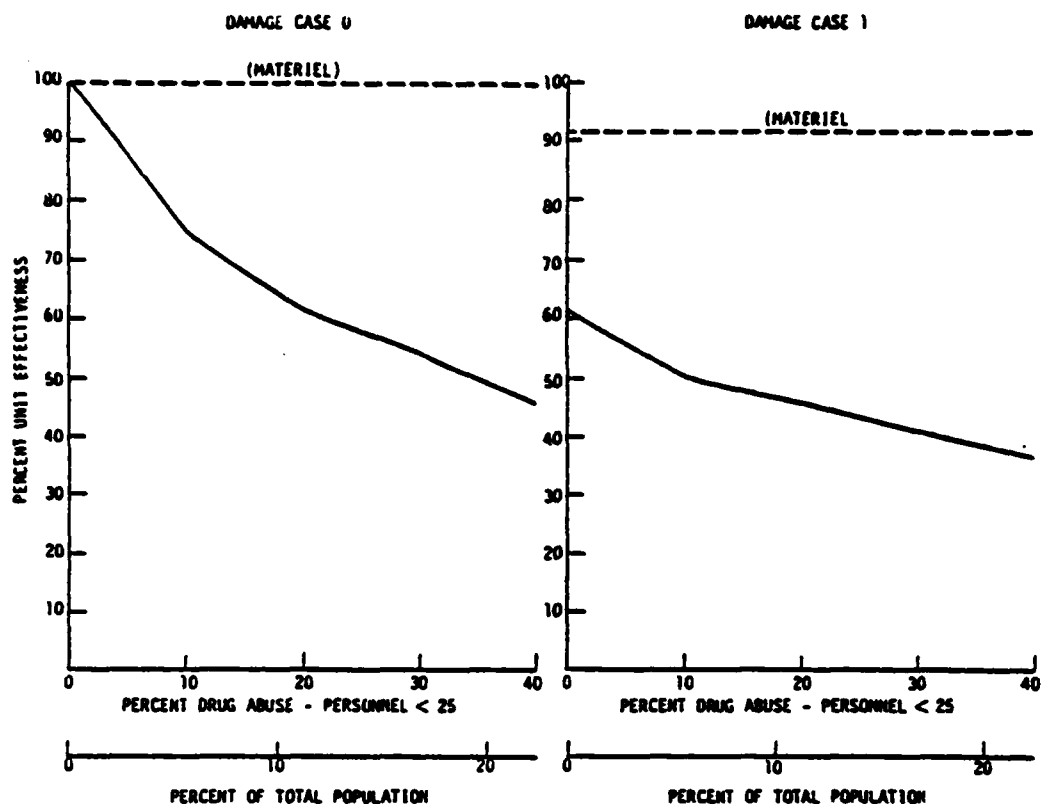


FIGURE 4-9. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE (CASE 0 AND 1) AND VARIOUS LEVELS OF DRUG ABUSE, HEADQUARTERS BATTERY, ARTILLERY BATTALION.

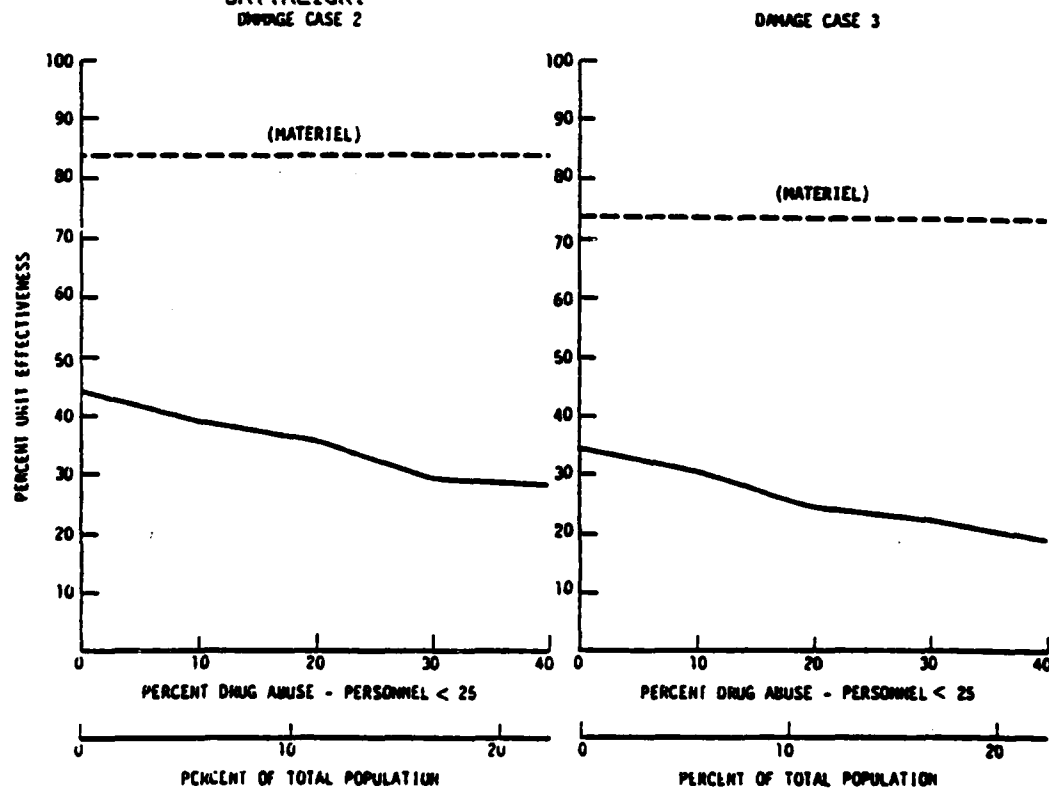


FIGURE 4-10. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE (CASE 2 AND 3) AND VARIOUS LEVELS OF DRUG ABUSE, HEADQUARTERS BATTERY, ARTILLERY BATTALION.

DAMAGE CASE 0 HEADQUARTERS BTRY, FIELD ARTY BN

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS				
		DRUG LEVEL				
TASK	NO	0	1	2	3	4
CHART OPR	32	X	X	X	X	X
SURV SPC	29	X	X	X	X	X
FDC COMP	31	X	X	X	X	X
SURV C/P	38	X	X	X	X	X
WIRE CH	50	X	X	X	X	X
CH FD CMP	30		X			
RTT OPR	54	X	X	X	X	
CH SURV	37		X			
INTEL OFF	33	X				
SIRE SPC	51	X	X	X	X	
FIRE SUP SGT	57	X	X	X	X	
SR FD SGT	58	X	X	X	X	
TYM	11	X	X	X	X	
RECON OFF	36	X				
WVM	13	X	X	X	X	
FD SPC	60	X	X	X		
BN CMR	1					
REDEYE SGT	23					
INTEL SGT	34					
FDO	28					
REDEYE CH	24	X	X	X		
REDEYE GUN	25	X	X			
FO SGT	59	X	X	X		
FSO BN	56					
SR WVM	12		X	X	X	
S2	27					
S3	26					
MOTOR SGT	7					
RTT SPC	53	X	X	X	X	
WIRE SPC	40	X				
CHEM SGT	43		X			
INTEL SPC	35	X	X			
COMD SPC	49	X	X	X	X	
RTT CH	52					
PLY LDR	46	X	X			
SR COM CH	47					
OPS SGT	29					
FSO BDE	55					
CARRIER DR	41					X
BTRY CO	6					
TYM	10					
BN MTR O	3					
LT VEH DR	21		X			
REDEYE O	22	X	X			

REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS				
TASK	NO	0	1	2	3	4
BN XO	2		X	X	X	
LT VEH DR	44			X	X	X
COMD CH	48	X	X			X

CRITICAL EQUIPMENT	
CARRIER, CMD POST	
CARRIER, PERSONNEL	
TRUCK, CARGO 14 T	

FIGURE 4-11. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE CASE 0, HEADQUARTERS BATTERY, FIELD ARTILLERY BATTALION.

DAMAGE CASE 1 HEADQUARTERS BTRY, FIELD ARTY BN

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS				
		DRUG LEVEL				
TASK	NO	0	1	2	3	4
CHART OPR	32	X	X	X	X	X
SURV SPC	29	X	X	X	X	X
FDC COMP	31	X	X	X	X	X
SURV C/P	38	X	X	X	X	X
WIRE CH	60	X	X	X	X	X
CH FD CMP	30	X	X	X	X	X
RTT OPR	54	X	X	X	X	X
CH SURV	37	X	X	X	X	X
INTEL OFF	33	X	X	X	X	X
SIRE SPC	51	X	X	X	X	X
FIRE SUP SGT	57	X	X	X	X	X
SR FD SGT	58	X	X	X	X	X
TVH	11	X	X	X	X	X
RECON OFF	36	X	X	X	X	X
WVM	13	X	X	X	X	X
FO SPC	60	X	X	X	X	X
BN CMOR	1	X	X	X	X	X
REDEYE SGT	23	X	X	X	X	X
INTEL SGT	34	X	X	X	X	X
FDO	28	X	X	X	X	X
REDEYE CH	24	X	X	X	X	X
REDEYE GUN	25	X	X	X	X	X
FO SGT	59	X	X	X	X	X
FSO BN	56	X	X	X	X	X
SR WVM	12	X	X	X	X	X
S2	27	X	X	X	X	X
S3	26	X	X	X	X	X
MOTOR SGT	7	X	X	X	X	X
RTT SPC	53	X	X	X	X	X
WIRE SPC	40	X	X	X	X	X
CHEM SGT	43	X	X	X	X	X
INTEL SPC	35	X	X	X	X	X
COMO SPC	49	X	X	X	X	X
RTT CH	52	X	X	X	X	X
PLT LDR	46	X	X	X	X	X
SR COM CH	47	X	X	X	X	X
OPS SGT	29	X	X	X	X	X
FSO BDE	55	X	X	X	X	X
CARRIER DR	41	X	X	X	X	X
BTRY CO	5	X	X	X	X	X
TVH	10	X	X	X	X	X
BN MTR O	3	X	X	X	X	X
LT VEN DR	21	X	X	X	X	X
REDEYE O	22	X	X	X	X	X

REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS				
TASK	NO	0	1	2	3	4
BN XO	2	X	X	X	X	X
LT VEN DR	44	X	X	X	X	X
COMM CH	48	X	X	X	X	X

CRITICAL EQUIPMENT	
CARRIER, CMD POST	
CARRIER, PERSONNEL	
TRUCK, CARGO 14 T	

FIGURE 4-12. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE CASE 1, HEADQUARTERS BATTERY, FIELD ARTILLERY BATTALION.

DAMAGE CASE 2 HEADQUARTERS BTRY, FIELD ARTY BN

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS				
		DRUG LEVEL				
TASK	NO	0	1	2	3	4
CHART OPR	32	X	X	X	X	X
SURV SPC	29	X	X	X	X	X
FDC COMP	31	X	X	X	X	X
SURV C/P	38	X	X	X	X	X
WIRE CH	50	X	X	X	X	X
CH PD CMP	30	X	X	X	X	X
RTT OPR	54	X	X	X	X	X
CH SURV	37	X	X	X	X	X
INTEL OFF	33	X	X	X	X	X
SIRE SPC	51	X	X	X	X	X
FIRE SUP SGT	57	X	X	X	X	X
SR PD SGT	58	X	X	X	X	X
TYM	11	X	X	X	X	X
RECON OFF	36	X	X	X	X	X
WVM	13	X	X	X	X	X
PD SPC	60	X	X	X	X	X
BN CHOR	1	X	X	X	X	X
REDEYE SGT	23	X	X	X	X	X
INTEL SGT	34	X	X	X	X	X
PDO	28	X	X	X	X	X
REDEYE CH	24	X	X	X	X	X
REDEYE GUN	25	X	X	X	X	X
FO SGT	59	X	X	X	X	X
FSO BN	56	X	X	X	X	X
SR WVM	12	X	X	X	X	X
S2	27	X	X	X	X	X
S3	26	X	X	X	X	X
MOTOR SGT	7	X	X	X	X	X
RTT SPC	53	X	X	X	X	X
WIRE SPC	40	X	X	X	X	X
CHEM SGT	43	X	X	X	X	X
INTEL SPC	35	X	X	X	X	X
COMO SPC	49	X	X	X	X	X
RTT CH	52	X	X	X	X	X
PLT LDR	46	X	X	X	X	X
SR COM CH	47	X	X	X	X	X
OPS SGT	29	X	X	X	X	X
FSO BDE	55	X	X	X	X	X
CARRIER DR	41	X	X	X	X	X
BTRY CO	5	X	X	X	X	X
TYM	10	X	X	X	X	X
BN MTR O	3	X	X	X	X	X
LT. VEH DR	21	X	X	X	X	X
REDEYE O	22	X	X	X	X	X

REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS				
TASK	NO	0	1	2	3	4
BN XO	2	X	X	X	X	X
COMM CH	48	X	X	X	X	X

CRITICAL EQUIPMENT	
CARRIER, CMD POST	
CARRIER, PERSONNEL	
TRUCK, CARGO 14 T	

FIGURE 4-13. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE CASE 2, HEADQUARTERS BATTERY, FIELD ARTILLERY BATTALION.

DAMAGE CASE 3 HEADQUARTERS BTRY, FIELD ARTY BN

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS				
		DRUG LEVEL				
TASK	NO	0	1	2	3	4
CHART OPR	32	X	X	X	X	X
SURV SPC	29	X	X	X	X	X
FDC COMP	31	X	X	X	X	X
SURV C/P	38	X	X	X	X	X
WIRE CH	50	X	X	X	X	X
CH PD CMP	30	X	X	X	X	X
RTT OPR	54	X	X	X	X	X
CH SURV	37					
INTEL OFF	33		X	X	X	X
SIRE SPC	51		X	X	X	X
FIRE SUP SGT	57		X	X	X	X
SR PD SGT	58		X	X	X	X
TYM	11	X	X	X	X	X
RECON OFF	36	X	X	X	X	X
WYM	13	X	X	X	X	X
FD SPC	60	X	X	X	X	X
BN CHOR	1	X	X	X	X	X
REDEYE SGT	23	X	X	X	X	X
INTEL SGT	34	X	X	X	X	X
FDO	28	X	X	X	X	X
REDEYE CH	24	X	X	X	X	X
REDEYE GUN	25	X	X	X	X	X
PD SGT	59					
FSO BN	56					
SR WYM	12	X	X	X	X	X
S2	27	X	X	X	X	X
S3	26	X	X	X	X	X
MOTOR SGT	7	X	X	X	X	X
RTT SPC	53	X	X	X	X	X
WIRE SPC	40					
CHEM SGT	43					
INTEL SPC	35					
COMO SPC	49		X	X	X	X
RTT CH	52		X	X	X	X
PLY LDR	46					
SR COM CH	47	X	X	X	X	X
OPS SGT	29					
FSO BDE	55		X	X	X	X
CARRIER DR	41	X	X	X	X	X
BTRY CO	5					
TYM	10					
BN MTR O	3					
LT. VEH DR	21					
REDEYE O	22					

REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS				
TASK	NO	0	1	2	3	4
BN XO	2		X	X	X	X
COMM CH	48		X	X	X	X

CRITICAL EQUIPMENT	
CARRIER, CMD POST	
CARRIER, PERSONNEL	
TRUCK, CARGO 1 1/2 T	

FIGURE 4-14. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE CASE 3, HEADQUARTERS BATTERY, FIELD ARTILLERY BATTALION.

SECTION III

SERVICE BATTERY, FIELD ARTILLERY BATTALION

1. GENERAL

The service battery provides three major services to the battalion:

- Ammunition resupply,
- Automotive maintenance, and
- General supply.

Of these, ammunition resupply is fundamentally the most important. Figure 4-15 displays the organization and missions of the service battery.

This section follows the same outline as Section II; the figures and tables correspond in format, if not in content. Repetition in discussion will be avoided except when necessary for clarity. A more general treatment of the artillery units can be found in Sections I and II of this chapter, in Chapter II, or in the appendices.

2. TEAMS AND TRANSFER MATRICES

The functions of the service battery are listed in Table 4-3, followed by the MOSs and the line-number identification. The lengths of the bars correspond to the probability that personnel assigned to this function are less than twenty-five years old. In a service battery 62.8% of the personnel can be expected to be less than twenty-five years old, compared to 55.4% in headquarters battery.

The battery's complement of sixty-eight personnel were distributed among eleven essential teams. The ammunition resupply and battalion-level maintenance functions were given priority in the formation of teams for testing the resiliency of the battery. Command and control are not as important in a service battery as in a headquarters battery because service battery operates with greater decentralization. Figure 4-16 shows the cumulative essential team requirements. Figure 4-17 is the transfer matrix for personnel. Figures 4-18 and 4-19 are the essential team requirements and the

transfer matrix for materiel. The team requirements for personnel and materiel have been coordinated because the AMORE methodology treats these aspects simultaneously. The number of teams must be the same, and individual teams must have adequate complements of personnel and equipment.

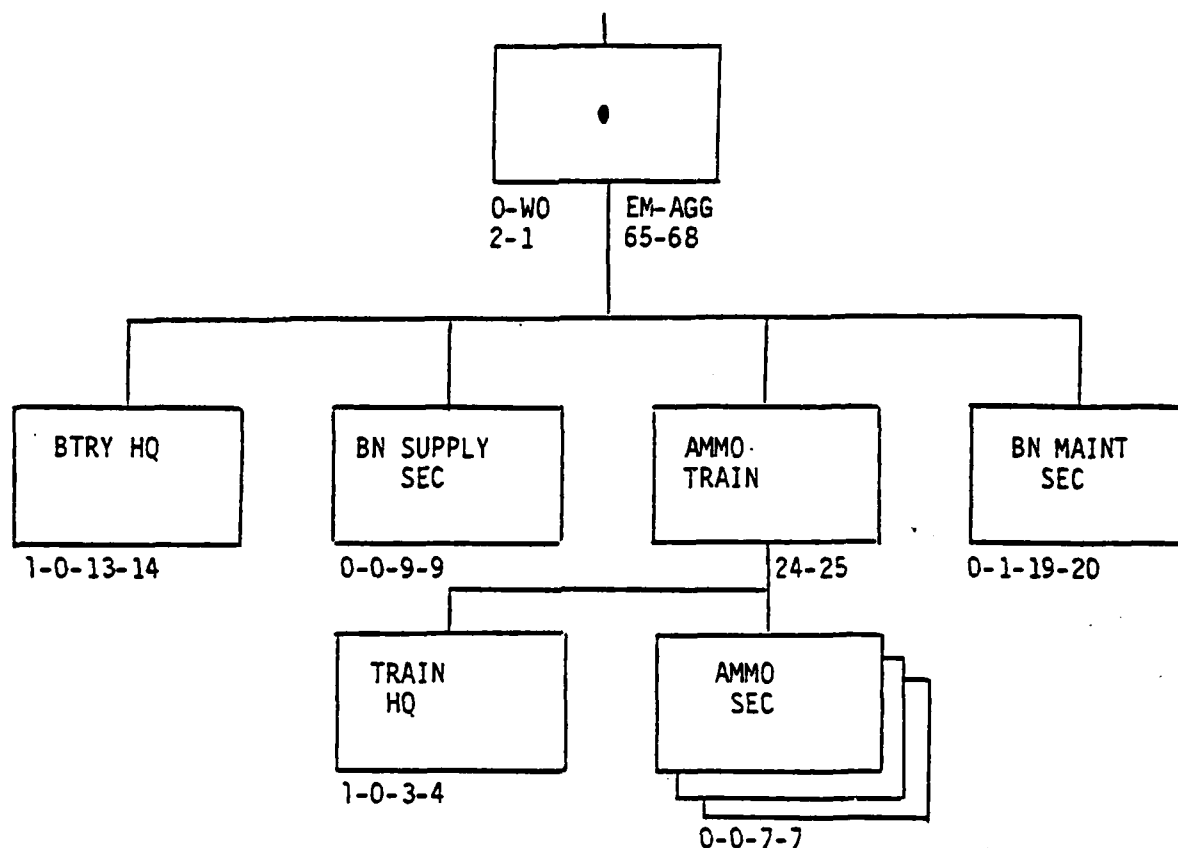
3. RESULTS

In Figure 4-20 the resiliency of service battery is displayed for the three levels of combat damage (excluding the zero damage level) used throughout this study. The unit's effectiveness is shown as a function of time following attack. In each case, personnel shortages rather than materiel shortages limited the maximum recovery level of the unit. The rapid recovery in the first two hours reflects the battery's adjustment to losses through transfer of personnel and equipment, in accordance with the options and constraints prescribed in the transfer matrices.

Figure 4-21 lists first the mission-essential personnel from the requirements laid out for the teams in Figure 4-16 and 4-18. The same experiments which produced the resiliency curves in Figure 4-20 yielded data on personnel and materiel shortages at each of four levels of combat damage. On this basis all but one of the mission-essential personnel functions are critical, but only two additional functions were required as substitutes.

In Figures 4-22 and 4-23 the maximum level of effectiveness after attacks is plotted as a function of varying levels of drug abuse for each of the four damage cases (including the 0 damage case). Two horizontal scales show the relationship between the incidence of drug abuse within the less-than-25 age group and the corresponding incidence within the total battery population. Note that the materiel limitation is never more limiting than personnel.

In Figures 4-24 through 4-27 the critical shortages among the mission-essential functions are identified. The same two functions, i.e., supply sergeant and wheel-vehicle mechanic, were required as substitutes for personnel previously determined to be critical.



COMBAT MISSION

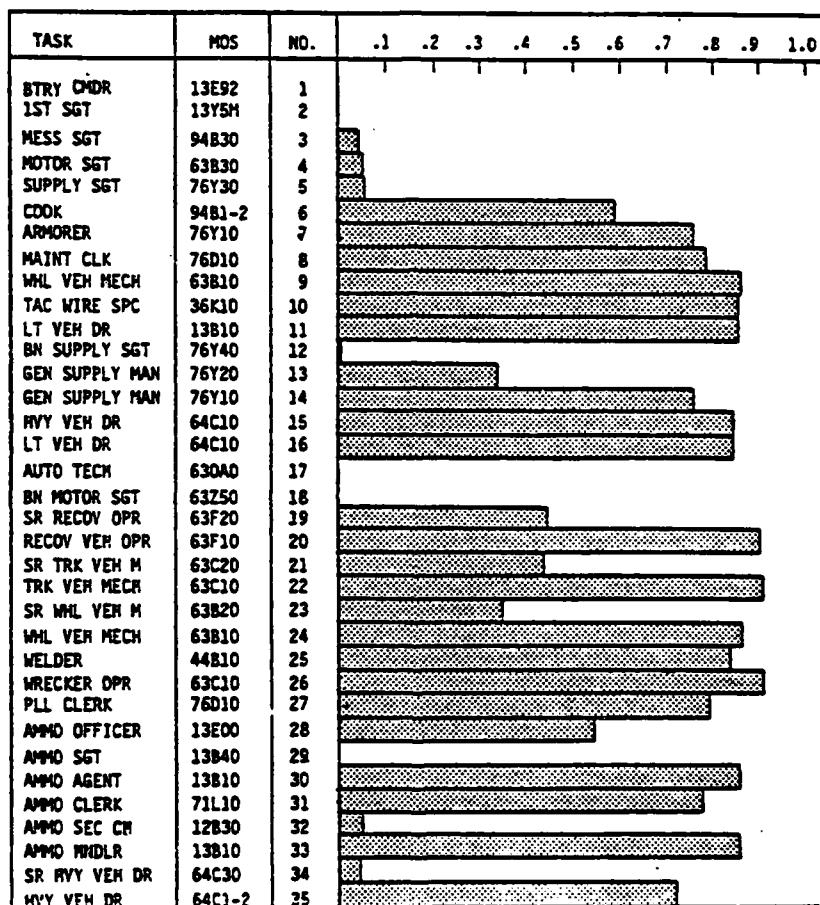
TO PROVIDE AND DISTRIBUTE ALL CLASSES OF SUPPLIES TO UNITS OF THE BATTALION, MAINTAIN SUPPLY RECORDS, AND PERFORM ORGANIZATIONAL LEVEL MAINTENANCE FUNCTIONS NOT OTHERWISE ACCOMPLISHED WITHIN THE BATTALION.

ASSUMED ANALYSIS MISSION

TO PROVIDE COMBAT SERVICE SUPPORT (PARTICULARLY AMMUNITION RE-SUPPLY) TO UNITS OF THE BATTALION IN SUPPORT OF THEIR PRIMARY COMBAT MISSIONS.

FIGURE 4-15. SERVICE BATTERY, FIELD ARTILLERY BATTALION, 155mm, SELF-PROPELLED, TOE 6-369H0-C16.

TABLE 4-3. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, SERVICE BATTERY, FIELD ARTILLERY BATTALION.



TITLE	LINE#	TOE	TEAMS										
			1	2	3	4	5	6	7	8	9	10	11
BC	1	1							1	1	1	1	1
1st SGT	2	1											1
MESS SGT	3	1											
MDTOR SGT	4	1				1	1	1	1	1	1	1	1
SUPPLY SGT	5	1											
COOK	6	3											
ARMOPER	7	1											
MAINT CLK	8	1											
PW GEN&MVH	9	2											
TAC WIRE SPC	10	1											
LT. VEH DR	11	1							1	1	1	1	1
BN SUPPLY SGT	12	1							1	1	1	1	1
GEN SUPPLYMAN	13	1											1
GEN SUPPLYMAN	14	2							1	2	2	2	2
HV VEH DR	15	2							1	1	1	1	2
LT VEH DR	16	3							1	2	2	2	2
AUTO MAINT TECH	17	1											1
MOTOR MAINT SGT	18	1					1	1	1	1	1	1	1
SR RECOV VEH OP	19	1						1	1	1	1	1	1
SR RECOV VEH OP	20	3						1	1	1	1	2	3
SR TRACK V.M.	21	1					1	1	1	1	1	1	1
SR TRACK V.M.	22	3	1	1	2	2	3	3	3	3	3	3	3
P.W. GEN & W.V.M.	23	2							1	1	2	2	2
PW GEN & W.V.M.	24	5		1	2	2	2	3	3	3	3	4	5
WELDER	25	1											
WRECKER OPR	26	1			1	1	1	1	1	1	1	1	1
PLL CLK	27	1											
AMMO OFFICER	28	1							1	1	1	1	1
AMMO SUP SGT	29	1			1	1	1	1	1	1	1	1	1
AMMO AGENT	30	1											1
AMMO CLERK	31	1											1
SEC CHIEF	32	3			1	1	1	2	2	2	2	3	3
AMMO HNDLR	33	9	1	2	3	4	5	6	6	7	8	9	9
HVY VEH DR	34	1											1
HVY VEH DR	35	8	1	2	3	4	5	6	6	7	8	8	8

FIGURE 4-16. CUMULATIVE TEAM REQUIREMENTS, PERSONNEL, SERVICE BATTERY, FIELD ARTILLERY BATTALION

[illegible]

FIGURE 4-17. TRANSFER MATRIX, PERSONNEL, SERVICE BATTERY, FIELD ARTILLERY BATTALION.

ITEM	LINE#	TOE	TEAMS										
			1	2	3	4	5	6	7	8	9	10	11
TRK. 1/2T(VRC-46)	1	1							1	1	1	1	1
TRK. 2 1/2T	2	2											
TRK. 2 1/2T W/W	3	1											
TRL. 1 1/2T	4	1											
TRL. TANK	5	1											
TRK. 2 1/2T	6	2							1	1	1	1	1
TRK. 5T	7	1									1	1	1
TRK. TANK, 2500g	8	2							1	1	1	1	2
TRL. 1 1/2T	9	1											
TRK. 1/2T(GRC-160)	10	1											1
TRK. 2 1/2T	11	2								1	1	1	1
TRK. 10T (WRECKER)	12	1			1	1	1	1	1	1	1	1	1
TRK. RECOV. VEH LT. HRM.	13	2						1	1	1	1	1	2
TRL. 1 1/2T	14	2											
TRL. 1/2T	15	1											
TRK. 1 1/2T(VRC-46)	16	1			1	1	1	1	1	1	1	1	1
TRK. 3T	17	9	1	2	3	4	5	6	6	7	8	9	9
TRL. 1 1/2T	18	9											

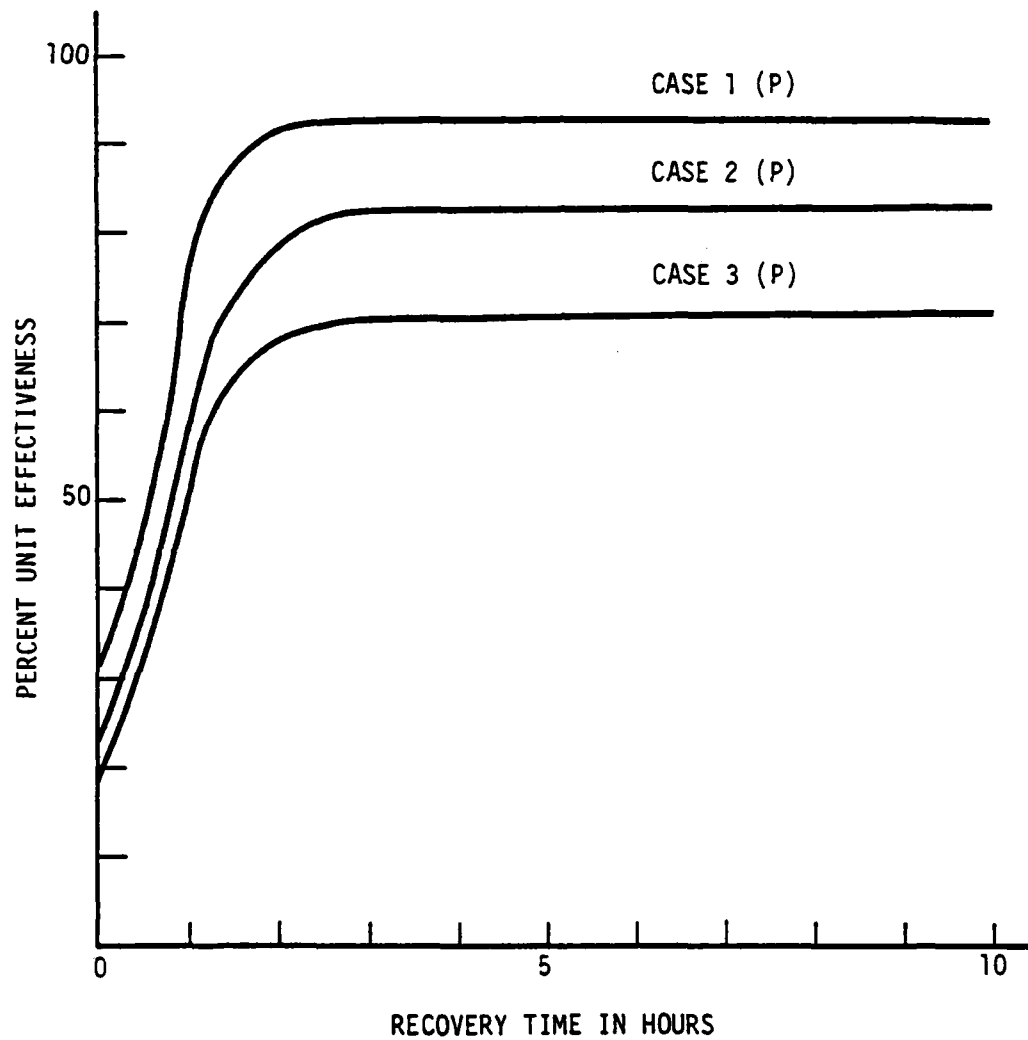
FIGURE 4-18. CUMULATIVE TEAM REQUIREMENTS MATERIEL, SERVICE BATTERY, FIELD ARTILLERY BATTALION.

TRANSFER MATRIX FOR MATERIEL

1	0	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	0	-1	-1	-1
2	30	0	0	0	-1	0	-1	-1	0	0	0	-1	-1	0	0	30	-1
3	30	0	0	0	-1	-1	-1	-1	0	0	0	-1	-1	0	0	30	-1
4	-1	-1	-1	0	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	0	-1	-1
5	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
6	30	0	0	0	-1	0	-1	-1	0	0	0	-1	-1	0	0	30	-1
7	-1	0	0	0	-1	0	0	-1	0	-1	0	-1	-1	0	0	-1	-1
8	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1
9	-1	-1	-1	0	-1	-1	-1	-1	0	-1	-1	-1	-1	0	0	-1	-1
10	0	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	0	-1	-1
11	30	0	0	0	-1	0	-1	-1	0	0	0	-1	-1	0	0	30	-1
12	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	-1	-1
13	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	-1	-1	-1	-1
14	-1	-1	-1	0	-1	-1	-1	-1	0	-1	-1	-1	-1	0	0	-1	-1
15	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	-1	-1
16	0	-1	-1	0	-1	-1	-1	-1	0	0	-1	-1	-1	0	0	-1	-1
17	-1	0	0	0	-1	0	0	-1	0	-1	0	-1	-1	0	0	-1	-1
18	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

FIGURE 4-19. TRANSFER MATRIX, MATERIEL, SERVICE BATTERY, FIELD ARTILLERY BATTALION.

SERVICE BATTERY, FIELD ARTILLERY BATTALION



- (P) PERSONNEL LIMITED
- (M) MATERIEL LIMITED
- (E) LIMITED EQUALLY BY PERSONNEL AND MATERIEL

FIGURE 4-20. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE AT THREE LEVELS, SERVICE BATTERY, FIELD ARTILLERY BATTALION.

COMBAT DAMAGE CASES, SERVICE BTRY, FIELD ARTY BN

MISSION ESSENTIAL PERSONNEL		CBT DAM LEVEL			
TASK	NO.	0	1	2	3
WRECKER OPR	26		X	X	X
TVM	22		X	X	X
SR. TVM	21		X	X	X
SR. RECOV OPR	19		X	X	X
BTRY CMDR	1		X	X	
HVY VEH DR	35		X	X	X
RECOV VEH OP	20		X	X	
WVM	24			X	X
AMMO HAND	33		X	X	X
SR. H.V. DR	34		X	X	X
MOTOR SGT	4		X	X	
MAINT SGT	18			X	X
BN SUP SGT	12		X	X	X
LT VEH DR	16				X
1ST SGT	2		X	X	
MAINT TECH	17		X	X	
AMMO SUPS	29			X	X
AMMO SEC CH	32		X	X	X
HVY VEH DR	15		X	X	
SR WVM	23		X	X	X
LT VEH DR	11			X	
AMMO OFF	28		X	X	X
SUPPLYMAN	14				X
AMMO AGENT	30			X	
AMMO CLK	31				
GEN SUP MAN	13				

REQUIRED SUBSTITUTES		CBT DAM LEVEL			
TASK	NO.	0	1	2	3
SUP SGT	5		X	X	X
WVM	9		X	X	X

CRITICAL EQUIPMENT
TRUCK, CARGO, 5T
TRUCK, TANK, 2500 g
TRUCK, WRECKER, 10T
TRACK RECOV VEH, L
TRUCK, CARGO, 8T

FIGURE 4-21. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF COMBAT DAMAGE, SERVICE BATTERY, FIELD ARTILLERY BATTALION.

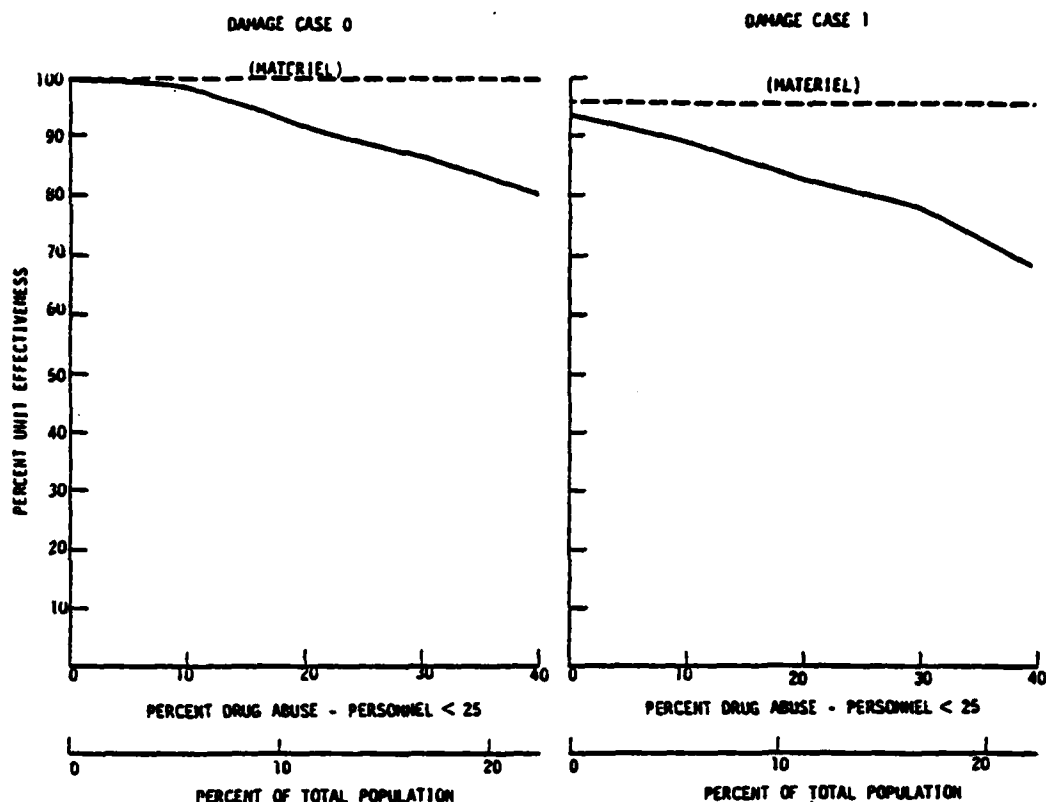


FIGURE 4-22. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE (CASES 0 AND 1) AND VARIOUS LEVELS OF DRUG ABUSE, SERVICE BATTERY, FIELD ARTILLERY BATTALION.

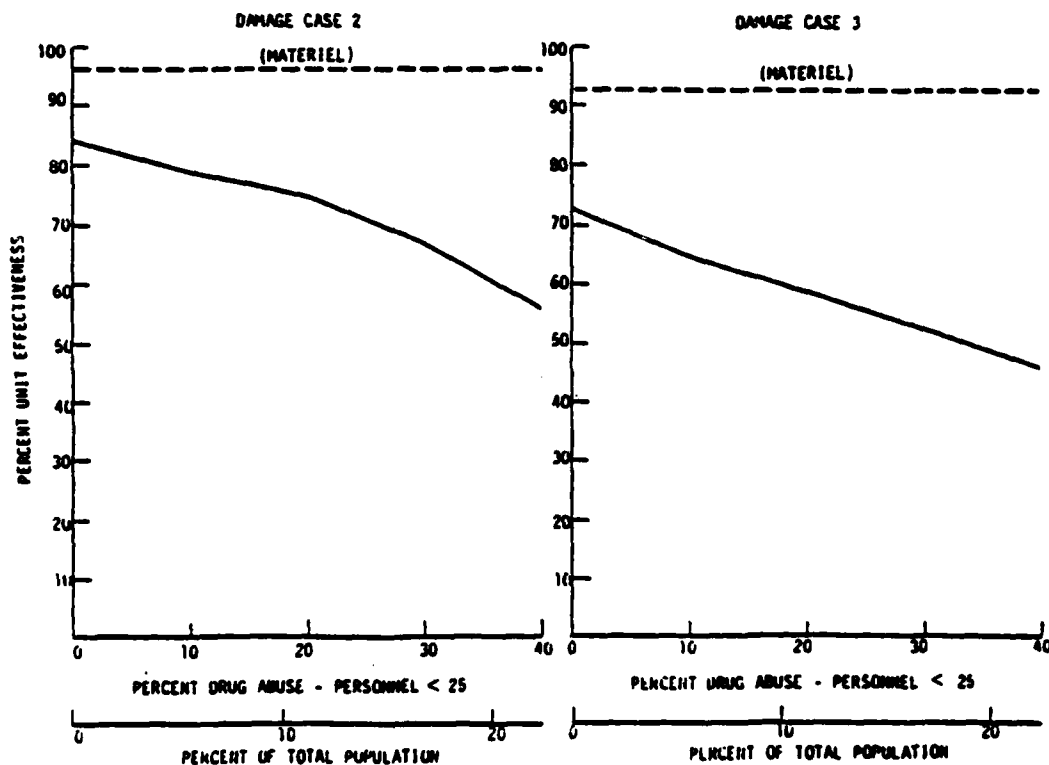


FIGURE 4-23. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE (CASES 2 AND 3) AND VARIOUS LEVELS OF DRUG ABUSE, SERVICE BATTERY, FIELD ARTILLERY BATTALION.

DAMAGE CASE 0, SERVICE BTRY, FIELD ARTY BN

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS DRUG LEVEL				
TASK	NO.	0	1	2	3	4
WRECKER OPR	26		X	X	X	X
TVM	22	X	X	X	X	X
SR. TVM	21		X	X	X	X
SR. RECOV OPR	19		X	X	X	X
BTRY CHDR	1					
HVY VEH DR	35	X	X	X	X	X
RECOV VEH OP	20	X	X	X	X	X
WVM	24		X	X	X	X
AMMO HAND	33	X	X	X	X	X
SR. H.V. DR	34					
MOTOR SGT	4					
MAINT SGT	18					
BN SUP SGT	12					
LT VEH DR	16		X	X	X	X
1ST SGT	2					
MAINT TECH	17					
AMMO SUPS	29					
AMMO SEC CH	32			X	X	X
HVY VEH DR	15		X	X	X	X
SR WVM	23				X	X
LT VEH DR	11			X	X	X
AMMO OFF	28				X	X
SUPPLYMAN	14				X	X
AMMO AGENT	30		X	X		
AMMO CLK	31					
GEN SUP MAN	13					

REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS				
TASK	NO.	0	1	2	3	4
SVP SGT	5			X	X	X
WVM	9		X	X	X	X

CRITICAL EQUIPMENT	
TRUCK, CARGO, 5T	
TRUCK, TANK, 2500g	
TRUCK, WRECKER, 10T	
TRACK RECOV VEH, LIGHT	
TRUCK, CARGO, 8T	

FIGURE 4-24. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE CASE 0, SERVICE BATTERY, FIELD ARTILLERY BATTALION.

DAMAGE CASE 1 SERVICE BTRY, FIELD ARTY BN

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS DRUG LEVEL				
TASK	NO.	0	1	2	3	4
WRECKER OPR	26	X	X	X	X	X
TVM	22	X	X	X	X	X
SR. TVM	21	X	X	X	X	X
SR. RECOV OPR	19	X	X	X		
BTRY CHDR	1	X	X			
HVY VEH DR	35	X	X	X	X	X
RECOV VEH OP	20	X	X	X	X	X
WVM	24	X	X	X	X	X
AMMO HAND	33	X	X	X	X	X
SR HV DR	34	X	X	X	X	X
MOTOR SGT	4	X	X			
MAINT SGT	18	X	X	X		
BN SUP SGT	12	X	X			
LT VEH DR	16	X	X		X	X
1ST SGT	2	X	X		X	
MAINT TECH	17	X	X	X		
AMMO SUPS	29	X	X	X		
AMMO SEC CH	32	X	X	X	X	
HVY VEH DR	15	X	X	X	X	X
SR WVM	23	X	X	X	X	X
LT VEH DR	11	X	X	X	X	X
AMMO OFF	28	X	X	X	X	X
SUPPLY MAN	14		X	X	X	X
AMMO AGENT	30		X	X		
AMMO CLK	31					
GEN SUP MAN	13					

REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS				
TASK	NO.	0	1	2	3	4
SUP SGT	5		X	X	X	X
WVM	9		X	X	X	X

CRITICAL EQUIPMENT	
TRUCK, CARGO, 5T	
TRUCK, TANK, 2500g	
TRUCK, WRECKER, 10T	
TRACK RECOV VEH, LIGHT	
TRUCK, CARGO, 8T	

FIGURE 4-25. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE CASE 1, SERVICE BATTERY, FIELD ARTILLERY BATTALION.

DAMAGE CASE 2, SERVICE BTRY, FIELD ARTY BN

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS DRUG LEVEL				
TASK	NO	0	1	2	3	4
WRECKER OPR	26	X	X	X	X	X
TVM	22	X	X	X	X	X
SR. TVM	21	X	X	X	X	X
SR. RECOV OPR	19	X	X	X	X	X
BTRY CHDR	1	X	X	X	X	X
HVY VEH DR	35	X	X	X	X	X
RECOV VEH OP	20	X	X	X	X	X
WVM	24	X	X	X	X	X
AMMO HAND	33	X	X	X	X	X
SR HV DR	34	X	X	X	X	X
MOTOR SGT	4	X	X	X	X	X
MAINT SGT	18	X	X	X	X	X
BN SUP SGT	12	X	X	X	X	X
LT VEH DR	16	X	X	X	X	X
1ST SGT	2	X	X	X	X	X
MAINT TECH	17	X	X	X	X	X
AMMO SUPS	29	X	X	X	X	X
AMMO SEC CH	32	X	X	X	X	X
HVY VEH DR	15	X	X	X	X	X
SR WVM	23	X	X	X	X	X
LT VEH DR	11	X	X	X	X	X
AMMO OFF	28	X	X	X	X	X
SUPPLY MAN	14	X	X	X	X	X
AMMO AGENT	30	X	X	X	X	X
AMMO CLK	31	X	X	X	X	X
GEN SUP MAN	13	X	X	X	X	X

REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS				
TASK	NO	0	1	2	3	4
SUP SGT	5	X	X	X	X	X
WVM	9	X	X	X	X	X

CRITICAL EQUIPMENT	
TRUCK, CARGO, ST	
TRUCK, TANK, 2500g	
TRUCK, WRECKER, 10T	
TRUCK RECOV VEH, LIGHT	
TRUCK, CARGO, ST	

FIGURE 4-26. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE CASE 2, SERVICE BATTERY, FIELD ARTILLERY BATTALION.

DAMAGE CASE 3 SERVICE BTRY, FIELD ARTY BN

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS DRUG LEVEL				
TASK	NO	0	1	2	3	4
WRECKER OPR	26	X	X	X	X	X
TVM	22	X	X	X	X	X
SR. TVM	21	X	X	X	X	X
SR. RECOV OPR	19	X	X	X	X	X
BTRY CHDR	1	X	X	X	X	X
HVY VEH DR	35	X	X	X	X	X
RECOV VEH OP	20	X	X	X	X	X
WVM	24	X	X	X	X	X
AMMO HAND	33	X	X	X	X	X
SR. H.V. DR	34	X	X	X	X	X
MOTOR SGT	4	X	X	X	X	X
MAINT SGT	18	X	X	X	X	X
BN SUP SGT	12	X	X	X	X	X
LT VEH DR	16	X	X	X	X	X
1ST SGT	2	X	X	X	X	X
MAINT TECH	17	X	X	X	X	X
AMMO SUPS	29	X	X	X	X	X
AMMO SEC CH	32	X	X	X	X	X
HVY VEH DR	15	X	X	X	X	X
SR. WVM	23	X	X	X	X	X
LT VEH DR	11	X	X	X	X	X
AMMO OFF	28	X	X	X	X	X
SUPPLY MAN	14	X	X	X	X	X
AMMO AGENT	30	X	X	X	X	X
AMMO CLK	31	X	X	X	X	X
GEN SUP MAN	13	X	X	X	X	X

REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS				
TASK	NO	0	1	2	3	4
SUP SGT	5	X	X	X	X	X
WVM	9	X	X	X	X	X

CRITICAL EQUIPMENT	
TRUCK, CARGO, ST	
TRUCK, TANK, 2500g	
TRUCK, WRECKER, 10T	
TRUCK RECOV VEH LIGHT	
TRUCK, CARGO, ST	

FIGURE 4-27. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE CASE 3, SERVICE BATTERY, FIELD ARTILLERY BATTALION.

SECTION IV

FIRING BATTERY, FIELD ARTILLERY BATTALION

1. GENERAL

The firing battery is the action arm of the artillery battalion. It services the weapons, in this case 155mm self-propelled howitzers. There are three identical firing batteries in an artillery battalion. Figure 4-28 shows this organization. Note the firing battery of six howitzer sections within the parent firing battery. The identical designation, although a possible source of confusion, gives evidence of the importance the artillery places on its primary weapons.

The ninety-nine personnel spaces in the battery were reduced to twenty-seven essential functions for analysis as shown in Table 4-4. On an expected-value basis, 66.9% of the battery personnel will be under twenty-five years of age.

The formats of the figures used to summarize the analysis of the firing battery and the order of their presentation in this section follow closely the analysis in Sections II and III of this chapter.

2. TEAMS AND TRANSFER MATRICES

Figures 4-29 through 4-32 are the essential teams and transfer matrices for personnel and equipment. The decision to use twelve teams in this analysis of the firing battery is based on the convenience with which the six howitzer sections can be sub-divided into twelve teams. The first team includes the minimum number of personnel (5) to fire the howitzer, the nucleus of the fire direction center, and the battery commander. The second team adds the remaining crewmen and an ammunition resupply element. The third team adds the second howitzer and five section personnel plus a communications operator and the driver of the fire-direction personnel carrier. This process is continued, filling teams alternatively with a howitzer and these same essential support. As with the headquarters battery and the service battery, mess, supply, and some other support personnel are not included in these essential teams.

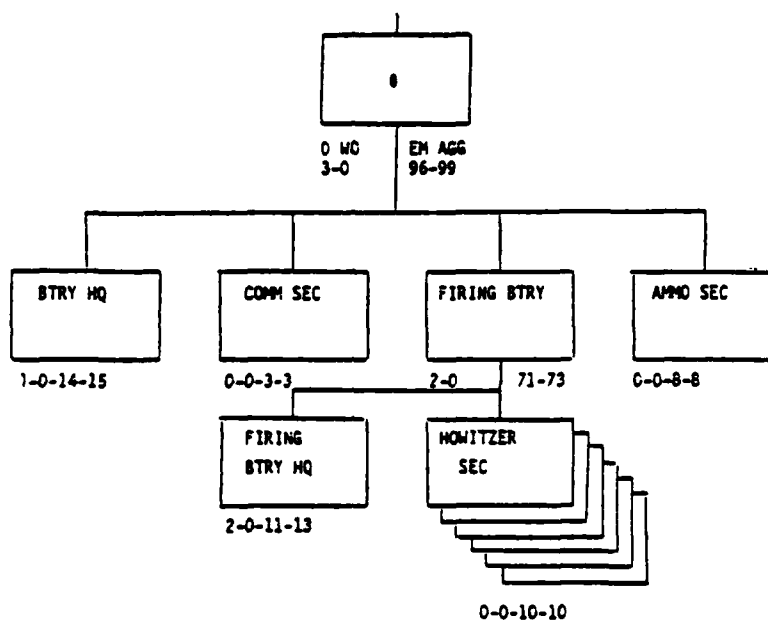
3. RESULTS

Figure 4-33 shows the response curves for three damage cases (1, 2, and 3) as a function of time after an attack. Note that in each case near-maximum effectiveness is achieved in about two hours following the attack. Case 1 is the only time in which materiel shortages limited overall effectiveness. In the other two cases here and in all those examined in headquarters battery and service battery, personnel shortages dominated the materiel shortages.

Figure 4-34 identifies the mission-essential personnel and, within this group, those determined to be critical. The aiming circle and the howitzer were the most critical items of materiel. Only the first sergeant, among the non-essential personnel, substituted for critical personnel.

Figures 4-35 and 4-36 show the maximum effectiveness achieved by the battery with combinations of combat damage and drug abuse. Note that in Damage Case 1 the materiel losses dominate personnel at the low drug-abuse levels.

Figures 4-37 through 4-40 identify the shortages of personnel which limited the unit effectiveness in the face of both combat and drug casualties.



COMBAT MISSION

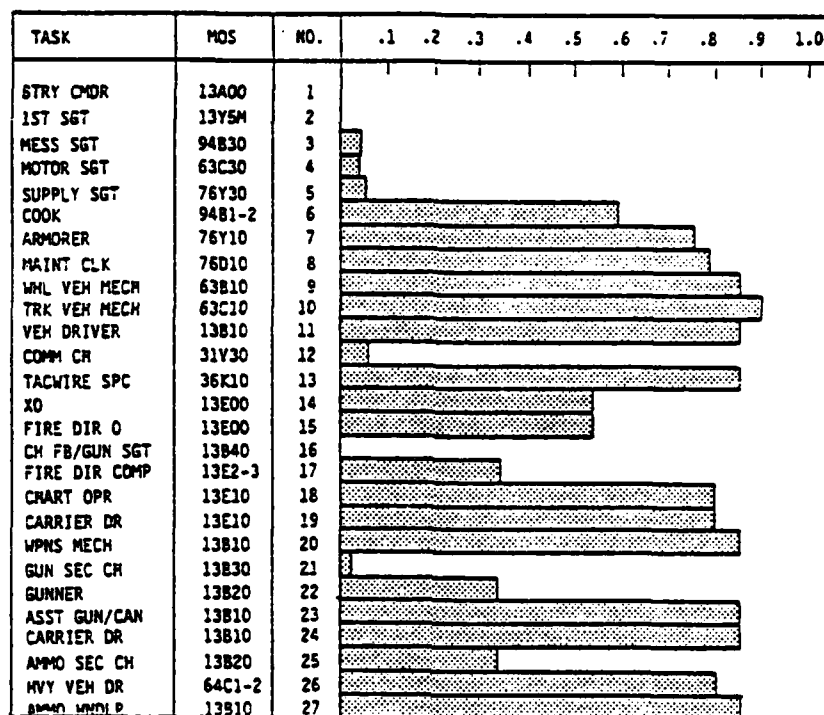
TO PROVIDE A FIRING COMPONENT OF THE FIELD ARTILLERY BATTALION,
155mm, SELF-PROPELLED

ASSUMED MISSION: FOR ANALYSIS

TO PROVIDE ARTILLERY FIRE THROUGH THE INTEGRATION OF THE
FUNCTIONS OF COMMAND, CONTROL, COMMUNICATIONS, TECHNICAL FIRE
DIRECTION, OPERATION OF SIX HOWITZERS, AND LIMITED AMMUNITION
RESUPPLY.

FIGURE 4-28. FIRING BATTERY, FIELD ARTILLERY BATTALION 155mm,
SELF-PROPELLED, TOE-6-36H0-C25.

TABLE 4-4. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, FIRING BATTERY, FIELD ARTILLERY BATTALION.



TITLE	LINE#	TOE	TEAM											
			1	2	3	4	5	6	7	8	9	10	11	12
CO	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1ST SGT	2	1												
MESS SGT	3	1												
MOTOR SGT	4	1												
SUPPLY SGT	5	1												
COOK	6	3												
ARMORER	7	1												
MAINT CLK	8	1												
PWR GEN WVM	9	1												
TRK VEH MECH	10	3												
VEH DR	11	1				1	1	1	1	1	1	1	1	1
COMMO CH	12	1				1	1	1	1	1	1	1	1	1
TAC WIRE SPC	13	2			1	1	1	1	1	1	1	1	1	2
XO	14	1						1	1	1	1	1	1	1
FDO	15	1	1	1	1	1	1	1	1	1	1	1	1	1
CH.FIRBTRY/GUNS.	16	2				1	1	1	1	1	1	1	2	2
FD COMPUTER	17	3	1	1	1	1	2	2	2	2	3	3	3	3
CHART OPR	18	3	1	1	1	1	1	2	2	2	2	2	3	3
CARRIER DR	19	1			1	1	1	1	1	1	1	1	1	1
FA WPNS MECH	20	2						1	1	1	1	1	1	2
SEC CH	21	6	1	1	2	2	3	3	4	4	5	5	6	6
GUNNER	22	6	1	1	2	2	3	3	4	4	5	5	6	6
ASST GUN/CFW	23	36	2	6	8	12	14	18	20	24	26	30	32	36
CARRIER DR	24	12	1	2	3	4	5	6	7	8	9	10	11	12
SEC CH	25	1			1	1	1	1	1	1	1	1	1	1
HVY VEH DR	25	5		2	2	3	3	5	5	5	5	5	5	5
AMP	27	2		1	1	2	2	2	2	2	2	2	2	2

FIGURE 4-29. CUMULATIVE TEAM REQUIREMENTS, PERSONNEL, FIRING BATTERY, FIELD ARTILLERY BATTALION.

[illegible]

FIGURE 4-30. TRANSFER MATRIX, PERSONNEL, FIRING BATTERY, FIELD ARTILLERY BATTALION.

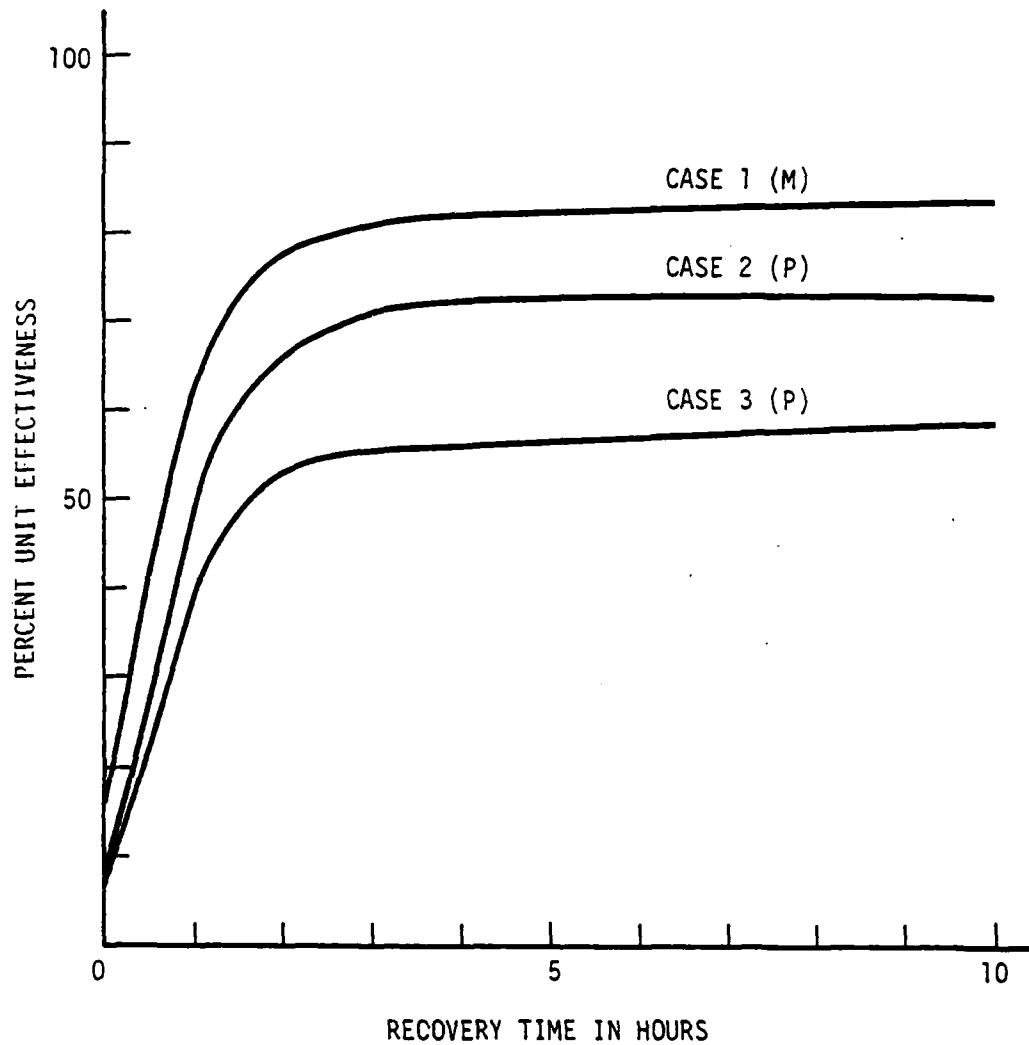
ITEM OF EQUIPMENT	LN #	TOE	TEAMS											
			1	2	3	4	5	6	7	8	9	10	11	12
TRUCK, ½T (VRC-47)	1	1					1	1	1	1	1	1	1	1
TRUCK, 2½T W/W	2	1												
TRUCK, 2½T	3	2												
TRAILER, 1½T	4	1												
TRAILER, WATER, 400	5	1												
CARRIER, CP(VRC-46)	6	1												
TRUCK, 1½T(2VRC-47)	7	1	1	1	1	1	1	1	1	1	1	1	1	1
TRAILER, 3/4T	8	1											1	1
AIMING CIRCLE	9	3	1	1	1	1	2	2	2	2	2	2	3	3
HOWITZER, SP 155mm	10	6	1	1	2	2	3	3	4	4	5	5	6	6
CARRIER, CARGO, 6T	11	6												
TRAILER, AMMO, 1½T	12	6												
TRUCK, 8T	13	3		1	1	2	2	3	3	4	4	5	5	6
TRAILER, AMMO, 1½T	14	3		1	1	2	2	3	3	3	3	3	3	3

FIGURE 4-31. CUMULATIVE TEAM REQUIREMENTS, MATERIEL, FIRING BATTERY, FIELD ARTILLERY BATTALION.

1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
2	30	0	0	0	-1	30	-1	0	-1	-1	-1	0	-1	0
3	30	0	0	0	-1	30	-1	0	-1	-1	-1	0	-1	0
4	-1	-1	-1	0	-1	-1	-1	0	-1	-1	-1	-1	-1	-1
5	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1
6	0	-1	-1	0	-1	0	30	0	-1	-1	-1	-1	-1	-1
7	0	30	30	0	-1	0	0	0	-1	-1	-1	-1	-1	-1
8	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1
9	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1
10	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1
11	-1	0	0	0	-1	30	30	0	-1	-1	0	0	0	0
12	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	0	0
13	-1	0	0	0	-1	30	30	0	-1	-1	0	0	0	0
14	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	0
	1	2	3	4	5	6	7	8	9	10	11	12	13	14

FIGURE 4-32. TRANSFER MATRIX, MATERIEL, FIRING BATTERY, FIELD ARTILLERY BATTALION.

FIRING BATTERY, FIELD ARTILLERY BATTALION



(P) PERSONNEL LIMITED

(M) MATERIEL LIMITED

(E) LIMITED EQUALLY BY PERSONNEL AND MATERIEL

FIGURE 4-33. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE AT THREE LEVELS, FIRING BATTERY, FIELD ARTILLERY BATTALION.

COMBAT DAMAGE CASES, FIRING BTRY , FIELD ARTY BN

MISSION ESSENTIAL PERSONNEL		CBT DAM LEVEL			
TASK	NO.	0	1	2	3
BTRY CMDR	1		X	X	X
FIRE DIR O	15		X	X	X
CHART OPR	18		X	X	X
XO	14		X	X	X
FD COMP	17		X	X	X
GUNNER	22		X	X	X
AMMO SEC. CH	25		X	X	
HVY VEH DR	26		X	X	X
COMO CH	12				X
CH FIR BTRY	16		X		
GUN SEC CH	21			X	X
ASST GUN/CAN	23		X	X	X
CARRIER DR	19				
AMMO HAND	27				
LT. VEH. DR.	11				
CARRIER DR	24				
WIRE SPC	13				
WPN MECH	20				

REQUIRED SUBSTITUTES		CBT DAM LEVEL			
TASK	NO.	0	1	2	3
1 SGT	2		X	X	X

CRITICAL EQUIPMENT
AIMING CIRCLE HOWITZER CARRIER, CARGO, 6T TRUCK, CARGO, 8T

FIGURE 4-34. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF COMBAT DAMAGE, FIRING BATTERY, FIELD ARTILLERY BATTALION.

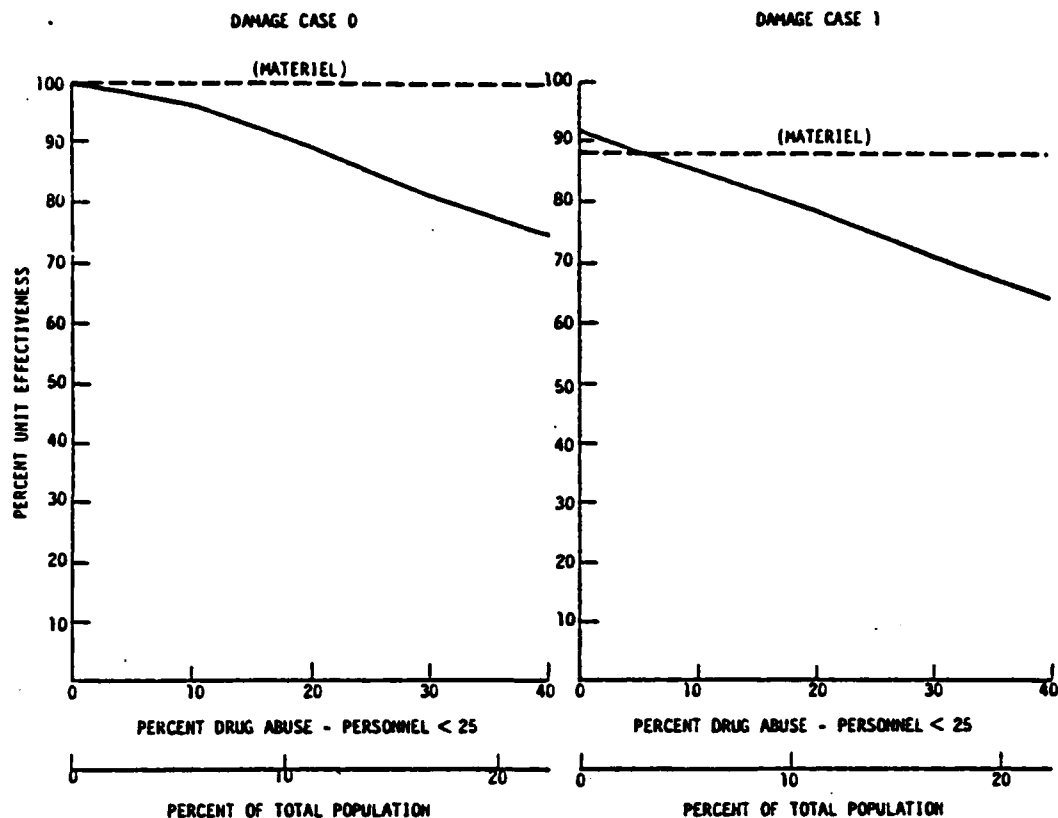


FIGURE 4-35. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE (CASES 0 AND 1) AND VARIOUS LEVELS OF DRUG ABUSE, FIRING BATTERY, FIELD ARTILLERY BATTALION.

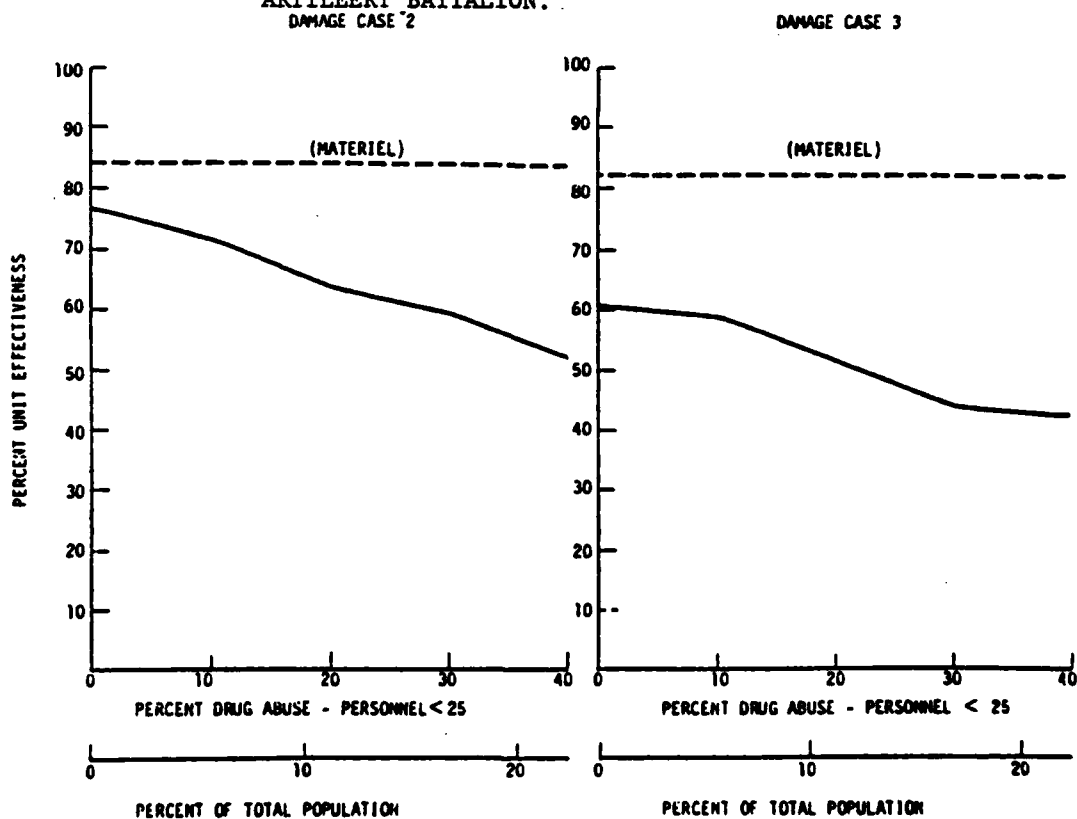


FIGURE 4-36. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE (CASES 2 AND 3) AND VARIOUS LEVELS OF DRUG ABUSE, FIRING BATTERY, FIELD ARTILLERY BATTALION.

DAMAGE CASE 0 FIRING BTRY, FIELD ARTY BN

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS				
		DRUG LEVEL				
TASK	NO	0	.1	.2	.3	.4
BTRY CMDR	1					
FIRE DIR O	15		X	X	X	X
CHART OPR	18		X	X	X	X
XD	14		X	X	X	X
FD COMP	17		X	X	X	X
GUNNER	22		X	X	X	X
AMMO SEC CH	25		X	X	X	X
HVY VEH DR	26		X	X	X	X
COMO CH	12					
CH FIR BTRY	16					
GUN SEC CH	21					
ASST GUN/CAN	23		X	X	X	X
CARRIER DR	19		X	X	X	X
AMMO HAND	27					
LT VEH DR	11					
CARRIER DR	24					
WIRE SPC	13		X			
WPN MECH	20		X			X

REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS				
TASK	NO	0	.1	.2	.3	.4
1 SGT	2		X	X	X	X
WVM	9		X	X	X	X
TVM	10		X	X	X	X

CRITICAL EQUIPMENT	
AIMING CIRCLE	
HOWITZER	
CARRIER, CARGO ET	
TRUCK, CARGO, ET	

FIGURE 4-37. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE 0, FIRING BATTERY, FIELD ARTILLERY BATTALION.

DAMAGE CASE 1 FIRING BTRY, FIELD ARTY BN

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS				
		DRUG LEVEL				
TASK	NO	0	.1	.2	.3	.4
BTRY CMDR	1	X	X	X	X	X
FIRE DIR O	15	X	X	X	X	X
CHART OPR	18	X	X	X	X	X
XD	14	X	X	X	X	X
FD COMP	17	X	X	X	X	X
GUNNER	22	X	X	X	X	X
AMMO SEC CH	25	X	X	X	X	X
HVY VEH DR	26	X	X	X	X	X
COMO CH	12	X	X	X	X	X
CH FIR BTRY	16	X	X	X	X	X
GUN SEC CH	21	X	X	X	X	X
ASST GUN/CAN	23	X	X	X	X	X
CARRIER DR	19	X	X	X	X	X
AMMO HAND	27	X	X	X	X	X
LT VEH DR	11	X	X	X	X	X
CARRIER DR	24	X	X	X	X	X
WIRE SPC	13	X	X	X	X	X
WPN MECH	20	X	X	X	X	X

REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS				
TASK	NO	0	.1	.2	.3	.4
1 SGT	2	X	X	X	X	X
WVM	9	X	X	X	X	X
TVM	10	X	X	X	X	X

CRITICAL EQUIPMENT	
AIMING CIRCLE	
HOWITZER	
CARRIER, CARGO ET	
TRUCK, CARGO, ET	

FIGURE 4-38. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE CASE 1, FIRING BATTERY, FIELD ARTILLERY BATTALION.

DAMAGE CASE 2 FIRING BTRY, FIELD ARTY BN

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS DRUG LEVEL					
TASK	NO.	0	1	2	3	4	
BTRY CMDR	1	X	X	X	X	X	
FIRE DIR O	15	X	X	X	X	X	
CHART OPR	18	X	X	X	X	X	
XO	14	X	X	X	X	X	
FD COMP	17	X	X	X	X	X	
GUNNER	22	X	X	X	X	X	
AMMO SEC CH	25	X	X	X	X	X	
HVY VEH DR	26	X	X	X	X	X	
COMO CH	12			X	X	X	
CH FIR BTRY	16		X				
GUN SEC CH	21	X	X	X			
ASST GUN/CAN	23	X	X	X	X	X	
CARRIER DR	19						
AMMO HAND	27			X	X	X	
LT. VEH DR.	11						
CARRIER DR	24		X	X	X	X	
WIRE SPC	13						
WPN MECH	20		X	X	X	X	

REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS					
TASK	NO.	0	1	2	3	4	
1 SGT	2		X	X	X	X	
WVM	9		X	X	X	X	
TVM	10		X	X	X	X	

CRITICAL EQUIPMENT	
AIMING CIRCLE	
HOWITZER	
CARRIER, CARGO, 6T	
TRUCK, CARGO, 8T	

FIGURE 4-39. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE CASE 2, FIRING BATTERY, FIELD ARTILLERY BATTALION.

DAMAGE CASE 3 FIRING BTRY, FIELD ARTY BN

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS DRUG LEVEL					
TASK	NO.	0	1	2	3	4	
BTRY CMDR	1	X	X	X	X	X	
FIRE DIR O	15	X	X	X	X	X	
CHART OPR	18	X	X	X	X	X	
XO	14	X	X	X	X	X	
FD COMP	17	X	X	X	X	X	
GUNNER	22	X	X	X	X	X	
AMMO SEC CH	25	X	X	X	X	X	
HVY VEH DR	26	X	X	X	X	X	
COMO CH	12	X			X	X	
CH FIR BTRY	16						
GUN SEC CH	21	X	X	X	X		
ASST GUN/CAN	23	X	X	X	X	X	
CARRIER DR	19			X	X	X	
AMMO HAND	27		X	X	X	X	
LT. VEH DR.	11						
CARRIER DR	24		X	X	X	X	
WIRE SPC	13						
WPN MECH	20					X	

REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS					
TASK	NO.	0	1	2	3	4	
1 SGT	2		X	X	X	X	
WVM	9		X	X	X	X	
TVM	10		X	X	X	X	

CRITICAL EQUIPMENT	
AIMING CIRCLE	
HOWITZER	
CARRIER, CARGO, 6T	
TRUCK, CARGO, 8T	

FIGURE 4-40. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE CASE 3, FIRING BATTERY, FIELD ARTILLERY BATTALION.

SECTION V

SUMMARY

In this chapter the three major unique subordinate units within the 155mm self-propelled howitzer battalion were examined. These units were the headquarters battery, the service battery, and the field artillery or firing battery.

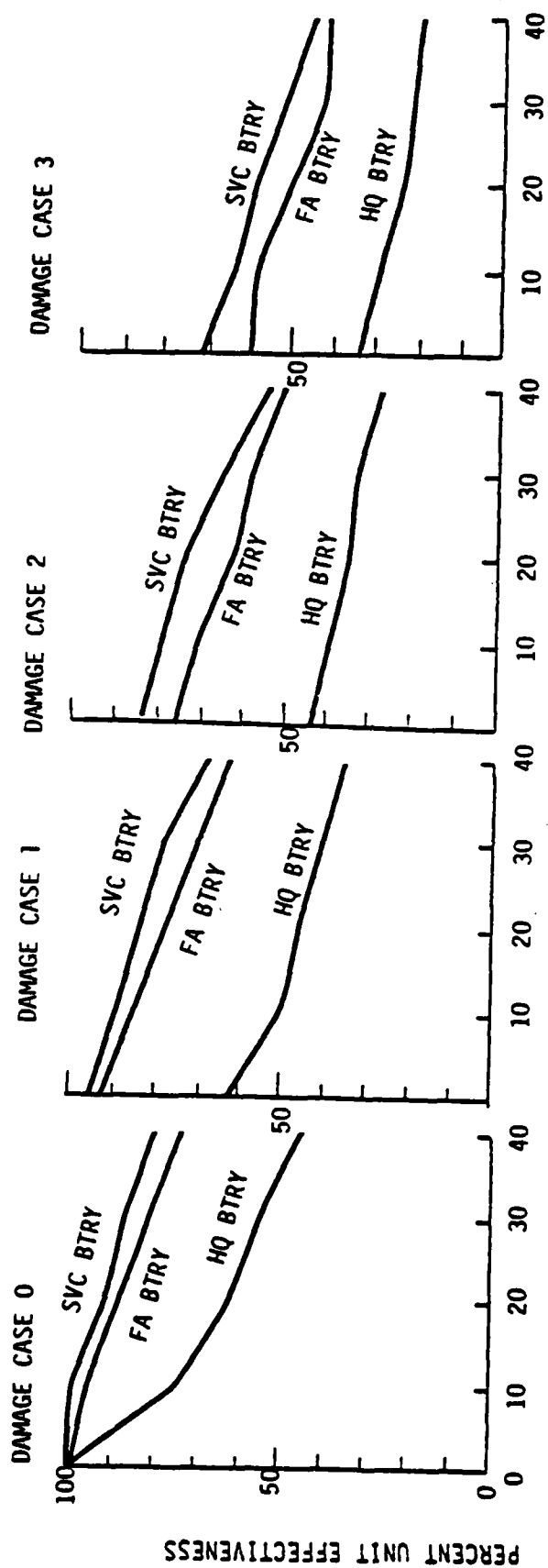
The essential functions required for the defensive mission assumed were identified, and teams were formed to execute these functions. At four levels of combat losses (personnel and equipment), the AMORE methodology determined the critical personnel whose absence or shortage limited the recovery of each unit's effectiveness. Then, for each of the combat losses assumed (0%, 10%, 20%, and 30%), the incidence of drug use was varied (0%, 10%, 20%, 30%, and 40%) to determine the interactive influence of drug use and combat casualties on each unit's capability. This analysis resulted in twenty combinations of data points for each unit. The results are summarized in Figure 4-41.

In general, the units can be ranked in terms of ability to recover after combat and drug losses as follows:

Service Battery
Firing Battery
Headquarters Battery

The order can be attributed to the greater redundancy that exists in the service battery and the firing battery compared to headquarters battery. Headquarters battery in particular and the artillery battalion in general utilize series operations with many critical functions being interdependent. In addition, many of these functions are performed by specialists who cannot easily transfer to other jobs in the event of casualties. These results reemphasize the continuing need for maximum cross-training in artillery units and judicious choice of equipment levels for increasing redundancy.

Materiel losses did not, in general, limit the recoverability of artillery units. Rather the limiting factor was usually personnel. The firing battery at Damage Case 1, without drug abuse, was the only data point examined where materiel shortages set a limit on the



PERCENT OF SUSCEPTIBLE PERSONNEL ABUSING DRUGS

FIGURE 4-41. SUMMARY OF UNIT EFFECTIVENESS AT VARIOUS DRUG-ABUSE LEVELS AND DAMAGE CASES, FIELD ARTILLERY BATTALION.

potential recovery of the battery. In headquarters and service batteries, the limit was always personnel.

Regression lines were determined for each set of data points plotted in Figure 4-41. The slope of the regression lines for each case (disregarding the algebraic sign) appear in Table 4-5 and are a measure of the ratio of the percent of personnel effectiveness lost to the percent of increased drug abuse. This ratio represents the unit's tolerance to drug abuse. The higher the value in Table 4-5 the greater the risk. When the value exceeds 1.00, then the loss of effectiveness exceeds the increase in drug use. However, the reader should keep in mind that the measure of the incidence of drug abuse shown in Figure 4-41 and used to calculate the data in Table 4-5 is a percentage of those on drugs who are also less than twenty-five years old. The highest ratio in each damage case is circled. The risk at Damage Case 0 is highest in headquarters battery, but at high damage levels service battery becomes more vulnerable.

TABLE 4-5. TOLERANCE RATIOS, FIELD ARTILLERY BATTALION

	DAMAGE CASE			
	0	1	2	3
HQ BTRY	(1.30)	.59	.42	.38
SVC BTRY	.52	.63	(.70)	(.66)
FA BTRY	.68	(.71)	.64	.51

Finally, Tables 4-6a and 4-6b present collectively the critical personnel in the artillery battalion. From the group of personnel used to form the essential teams, subgroups (termed critical) were found that limited the effective recovery of each unit after attack. Table 4-6a lists those personnel found to be critical based on analysis of combat losses. Table 4-6b identifies additional personnel, not identified previously in Table 4-6a, who were found to be critical based on analysis of incidence of drug abuse. Table 4-6b also includes the probability that these additional personnel are less than 25 years of age.

TABLE 4-6. CRITICAL PERSONNEL FROM COMBAT DAMAGE AND DRUG ABUSE,
FIELD ARTILLERY BATTALION.

a. Personnel Critical From Combat Damage Only

HEADQUARTERS BATTERY	SERVICE BATTERY	FIRING BATTERY
TASK	TASK	TASK
CHART OPR	WRECKER OPR	BTRY CMDR
SURV SPC	TVM	FIRE DIR O
FDC COMP	SR TYM	CHART OPR
SURV C/P	SR RECOV OPR	XO
WIRE CH	BTRY CMDR	FD COMP
CH FD CMP	HVY VEH DR	GUNNER
RTT OPR	RECOV VEH OP	AMMO SEC CH
CH SURV	WVM	HVY VEH DR
INTEL OFF	AMMO HAND	COMO CH
WIRE SPC	SR. HV DR	CH FIR BTRY
FIRE SUP SGT	MOTOR SGT	GUN SEC CH
SR FD SGT	MAINT SGT	ASST GUN/CAN
TVM	BN SUP SGT	
RECON OFF	LT VEH DR	
WVM	1ST SGT	
FD SPC	MAINT TECH	
BN CMDR	AMMO SUPS	
REDEYE SGT	AMMO SEC CH	
INTEL SGT	HVY VEH DR	
FDO	SR WVM	
REDEYE CH	LT VEH DR	
REDEYE GUN	AMMO OFF	
FD SGT	SUPPLYMAN	
FSO BN	AMMO AGENT	
SR WVM		
S2		
S3		
MOTOR SGT		
RTT SPC		
WIRE SPC		
CHEM SGT		
INTEL SPC		
COMO SPC		
RTT CH		
PLT LDR		
SR COM CH		
OPNS SGT		
FSO BDE		
CARRIER DR		

b. Personnel Critical From Combat Damage Only

HEADQUARTERS BATTERY	SERVICE BATTERY	FIRING BATTERY
TASK	TASK	TASK
LT VEH DR	AMMO AGENT	CARRIER DR
REDEYE O		AMMO HANDLR
		LT VEH DR
		WIRE SPC
		WPN MECH

CHAPTER FIVE
THE INFANTRY BATTALION (MECHANIZED),
ARMORED AND MECHANIZED DIVISION

SECTION I
GENERAL

The mechanized infantry battalion is a combat maneuver unit organized to fight as a task force in combination with tank companies, support by artillery, tactical air and other combat support forces. This chapter discusses those companies organic to the battalion. Other task-force elements, e.g., tank companies and artillery batteries, are treated separately in Chapters III and IV. The mechanized infantry battalion organization is shown in Figure 5-1. This battalion has three unique companies: headquarters and headquarters company (HCC), combat support company (C/S), and three rifle companies. For analysis purposes it was assumed that these companies were engaged in intensive combat defending against a tank-heavy force. The measure of effectiveness was the unit's ability to perform those functions required for this situation for a brief period of time (twenty-four hours). Input data for AMORE analysis was based on this situation. Each company was analyzed at four damage levels, called Damage Cases 0, 1, 2, and 3. Each case relates to a specific probability of producing a personnel casualty and the associated damage to equipment. Combinations of combat casualties and the associated damage to equipment for the infantry battalion units are listed in Table 5-1. Casualties resulting from drug abuse were considered at four levels (10, 20, 30, and 40 percent) for each of the assumed combat-damage levels, providing data for sixteen combinations of combat damage and drug abuse.

An important input to the AMORE methodology is the grouping of personnel functions and materiel items into teams which are essential for accomplishment of the unit's mission. The TOE for each unit was examined in detail, identifying task and section groups required to perform the unit's primary combat mission. Care was exercised to retain the resolution of individual MOS skills. The number of essential teams formed for each type unit was determined by the functions required to perform its primary combat mission and the organizational structure of that unit. Generally speaking, tasks not required for short intensive combat were not required in the essential team build. Input for the headquarters and headquarters company is discussed in Section II. The input for the combat support company is in Section III, and in Section IV for the rifle company.

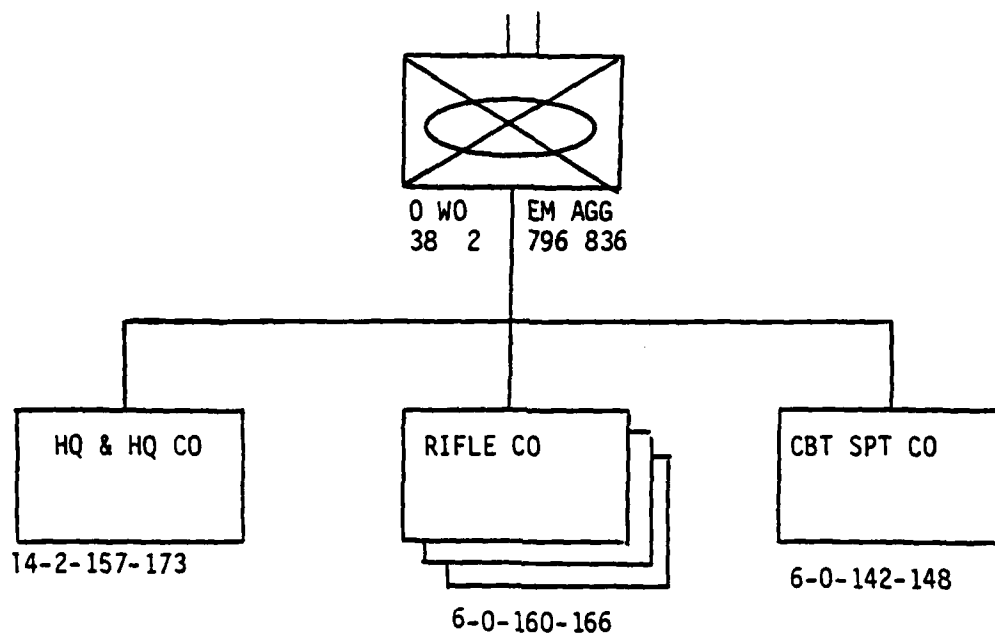


TABLE 5-1. DAMAGE COMBINATION PROBABILITIES FOR PERSONNEL AND CORRESPONDING EQUIPMENT DAMAGE FOR COMBAT DAMAGE CASES, INFANTRY BATTALION (MECHANIZED).

UNIT COMPONENTS			DAMAGE CASE			
			0	1	2	3
HEADQUARTERS & HQ CO						
	PERSONNEL:		0	.10	.20	.30
	EQUIPMENT:	LT	0	.20	.20	.30
		MOD	0	.14	.26	.40
		SEV	0	.02	.04	.07
COMBAT SUPPORT CO.						
	PERSONNEL:		0	.10	.20	.30
	EQUIPMENT:	LT	0	.10	.10	.40
		MOD	0	.06	.19	.28
		SEV	0	.01	.06	.12
RIFLE CO						
	PERSONNEL:		0	.10	.20	.30
	EQUIPMENT:	LT	0	.10	.10	.40
		MOD	0	.06	.19	.28
		SEV	0	.01	.06	.12

SECTION II

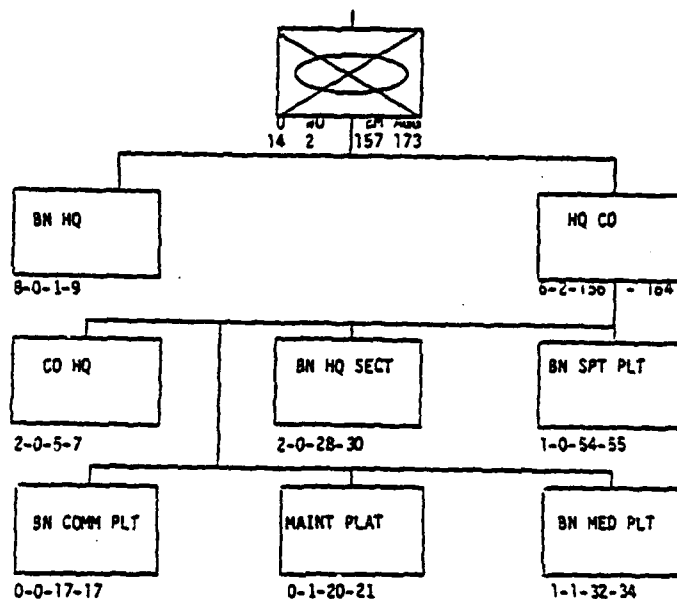
HEADQUARTERS AND HEADQUARTERS COMPANY, INFANTRY BATTALION (MECHANIZED)

1. GENERAL

Headquarters and headquarters company provides the command, control and supervision for the subordinate battalions and attached units. Organized as shown in Figure 5-2, the company also provides transportation, supply, maintenance and medical services.

2. TEAMS AND MATRICES

Personnel tasks for this analysis (identified by MOS) are shown in Table 5-2, along with their task number and probability that individuals in this MOS are less than twenty-five years of age. The fifty-six tasks are organized around five functional teams, each of which adds an equal increment (twenty percent) of capability to the company's effectiveness in performing its basic combat mission. A maximum of five essential teams was established in order for one team to receive orders and pass reports to higher and adjacent units. The cumulative team structure is shown in Figure 5-3. This shows the total requirement for each task to build a given number of essential teams. Thus, to function at the lowest level (build at least one team), a battalion commander, staff officer, staff NCO, one carrier driver, and light vehicle driver are required. To function at one-hundred percent would require the totals shown in Column 5. Other functions were not considered essential to providing command, control and communications necessary in the conduct of defensive operations over a short period of time. Resupply, food service, maintenance, and medical support would obviously be required if the unit were being analyzed for continuous combat or peacetime operations. That is not to say, however, that these personnel were not required in AMORE. Shortages (casualties) resulting from combat or drug abuse may require substitution of skills if feasible. Transfers allowable between personnel tasks are shown in Figure 5-4. This matrix matches personnel (rows) to functions (columns). Matrix entries show the time (in minutes) required for a row to assume a column's function (if required). Thus, the battalion executive officer or S-3 (row two), can assume the battalion commander's function (column one) in ten minutes. The entry "-1" indicates that the individual (in the row) cannot assume that particular function (in the column).



COMBAT MISSION

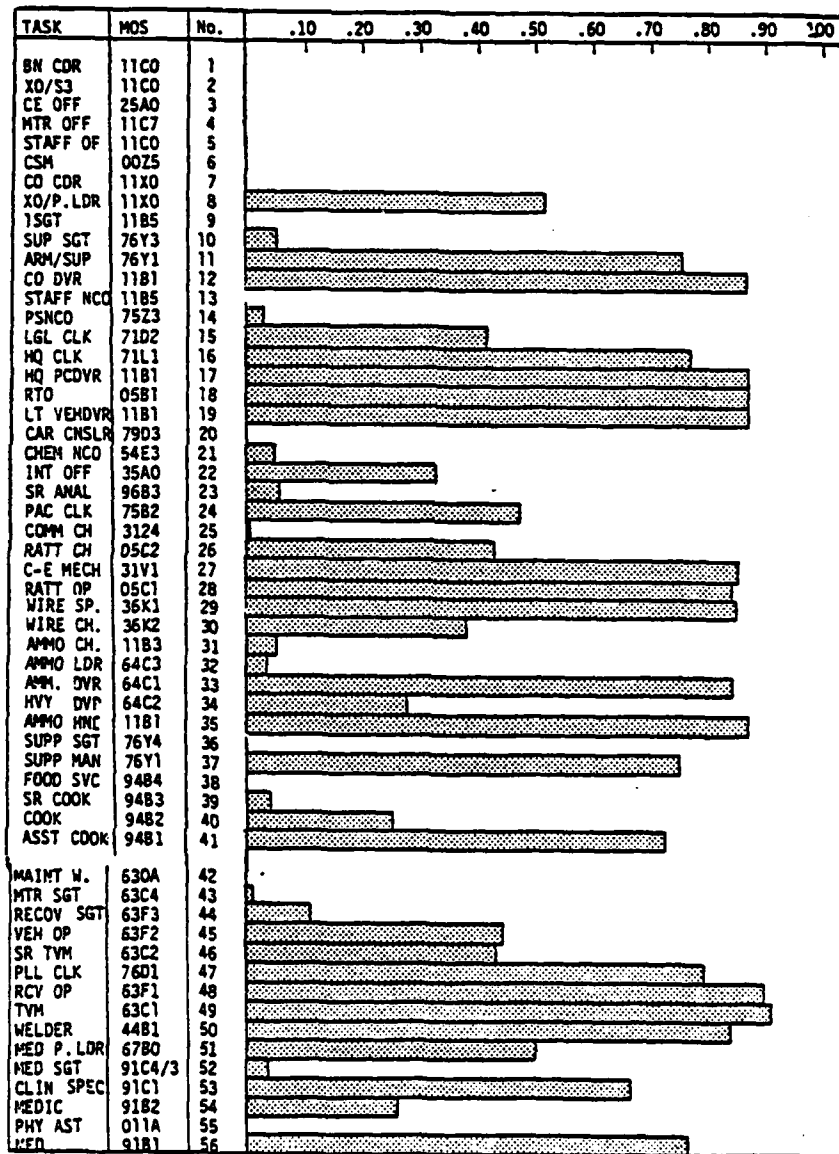
TO PROVIDE COMMAND, CONTROL AND SUPERVISION OF THE OPERATIONS OF THE MECHANIZED INFANTRY BATTALION AND ATTACHED UNITS

ANALYSIS MISSION

COMMAND, CONTROL AND SUPERVISE DEFENSE OPERATIONS IN INTENSIVE COMBAT AGAINST ARMOR HEAVY FORCE FOR SHORT PERIOD OF TIME (24 HOURS).

FIGURE 5-2. HEADQUARTERS AND HEADQUARTERS COMPANY, MECHANIZED, INFANTRY BATTALION, TOE-7-46HO-20-16.

TABLE 5-2. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, HEADQUARTERS COMPANY, INFANTRY BATTALION (MECH).



TASK	MOS	NO	TOE	REQUIRED TO BUILD TEAMS				
				1	2	3	4	5
BN CDR	11C0	1	1					
XO/S3	11C0	2	2	1	1	1	1	1
CE OFF	25A0	3	1		1	1	1	1
MTR OFF	11C7	4	1					
STF OFF	11C0	5	4	1	1	2	3	4
CSM	00Z5	6	1					
CO CDR	11X0	7	1			1	1	1
XO/P. LDR	11X0	8	2					
1 SGT	11B5	9	1					
SUP SGT	76Y3	10	1					
ARM/SGT	76Y1	11	2					
CO DVR	11B1	12	2		1	1	1	1
STF NCO	11B5	13	3	1	1	2	2	3
PS NCO	75Z3	14	2					
LGL CLK	71D2	15	1					
HQ CLK	71L1	16	2				1	1
HQ PC DRV	11B1	17	8	1	3	5	7	8
RTP	05B1	18	2			1	1	1
LT VEH DRV	11B1	19	5	1	2	3	4	4
CAR CHSLR	79D3	20	1					
CHEM NCO	54E3	21	1					
INT OFF	35AC	22	1			1	1	1
SR ANAL	96B3	23	1				1	1
PAC CLK	75B2	24	4					
COMM CH	31V4	25	1			1	1	1
RATT CH	05C2	26	1				1	1
C-E MECH	31V1	27	1				1	1
RATT OP	05C1	28	2			1	1	2
WIRE SP	36K1	29	9		2	4	5	6
WIRE CF	36K2	30	1				1	1
AMMO CH	11B2	31	1					
AMMO LDR	64C3	32	2					
AMMO VEH DRV	64C1	33	10					
HVY VEH DRV	64C2	34	3					
AMMO HNDLR	11B1	35	3					
SUPP SGT	76Y4	36	1					
SUPP MAN	76Y1	37	4					
FOOD SVC	94B4	38	5					
SR COOK	94B3	39	5					
COOK	94B2	40	4					
ASST COOK	94B1	41	15					
MAINT W.	630A	42	1					
MTR SGT	63C4	43	1					
RECOV SGT	63F3	44	1					
VEH OP	63F2	45	2					
SR TYM	63C2	46	2					
PLL CLK	7601	47	1					
RCV OP	63F1	48	3					
TYM	63C1	49	9					
WELDER	44B1	50	1					
MED P. LDR	67B0	51	1					
MED SGT	91C4/3	52	3					
CLIN SPEC	91C1	53	1					
MEDIC	91B2	54	11					
PHY AST	011A	55	1					
MED	91B1	56	19					
TOTAL			73					

FIGURE 5-3. CUMULATIVE TEAM REQUIREMENTS, PERSONNEL, HEADQUARTERS COMPANY, INFANTRY BATTALION (MECH).

FIGURE 5-4. TRANSFER MATRIX, MATERIEL, HEADQUARTERS COMPANY, INFANTRY BATTALION (MECH) (CONT'D).

Section	Item	Auth	Required to Build Teams				
			1	2	3	4	5
Bn Hq	1/4 TRK	6	1	2	3	4	5
	APC	3			1	2	3
	Cmd APC	4	1	2	3	3	3
	1 1/4 TRK	1					
Co Hq- Comm PLT	1 1/4 TRK	2			1	1	1
	2 1/4 TRK	1					
TNSP Sect.	8 TRK	5					
	5 TRK	5					
	5 Pump	1					
	Fuel Svc	2					
Supt PLT	1/4 TRK	1					
	2 1/4 TRK						
Maint Sect	2 1/4 TRK	2					
	RCV Veh	2					
	Med RCV	1					
Med PLT	1/4 TRK	1					
	2 1/4 TRK	1					
	Aid Sta.	1					
	Amb1	3					
	1 1/4 TRK	1					

FIGURE 5-5. CUMULATIVE TEAM REQUIREMENTS, MATERIEL, HEADQUARTERS COMPANY, INFANTRY BATTALION (MECH).

1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	0	-1	-1	-1	-1
2	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	15	-1
3	-1	0	0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
4	-1	-1	-1	0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
5	-1	-1	-1	0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
6	-1	-1	-1	0	0	0	-1	-1	-1	-1	0	0	0	-1	-1	-1	0	-1	-1	-1
7	-1	-1	-1	-1	-1	0	0	0	30	-1	-1	0	0	-1	-1	-1	0	-1	-1	-1
8	-1	-1	-1	0	0	0	-1	0	30	-1	-1	0	0	-1	-1	-1	0	-1	-1	-1
9	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
10	-1	-1	-1	-1	-1	-1	-1	-1	0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
11	20	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	0	-1	-1	-1	-1	-1
12	-1	-1	-1	0	0	0	-1	-1	-1	-1	0	0	-1	-1	-1	0	-1	-1	0	0
13	-1	-1	-1	0	0	0	-1	-1	-1	-1	0	0	-1	-1	-1	0	-1	-1	0	0
14	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1
15	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	-1	-1	-1	-1	-1
16	30	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	0	-1	-1	-1	-1
17	-1	-1	-1	0	0	0	-1	-1	-1	-1	0	0	-1	-1	-1	0	-1	-1	0	0
18	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1
19	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1
20	-1	-1	-1	0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

FIGURE 5-6. TRANSFER MATRIX, MATERIEL, HEADQUARTERS COMPANY, INFANTRY BATTALION (MECH).

Equipment required by the company is also organized into teams (Figure 5-5) to match the personnel teams. As with personnel functions, substitution is also allowed between equipment. Figure 5-6 shows for example that an eight-ton truck (item seven) can be used to replace a five-ton truck with pump (item nine) with a thirty-minute penalty to transfer the pumping equipment.

3. RESULTS

Using input as previously indicated, AMORE runs were made at three damage levels: Cases 1, 2, and 3. Zero drug abuse was assumed at this point. The resiliency, or the ability of the headquarters company to reconstitute essential teams from surviving assets, is shown in Figure 5-7. At Damage Case 1, the unit was able to operate (for this mission) at one-hundred percent after about five hours. It should be noted that in Case 1 the unit was constrained equally by damage to equipment and personnel casualties. At Cases 2 and 3, personnel casualties limited the unit's recoverability and effectiveness.

Figure 5-8 lists those functions which limited the unit's effectiveness at the different damage cases. Five personnel functions identified as critical (from the list of mission-essential tasks) are shown in their relative order of essentiality. It is not surprising that these functions are centered around communications, the key to command control. Similarly, the C-E officer and wire team chief also perform communications related tasks and, although not essential, were required to substitute and perform critical tasks. No equipment was identified as critical.

Age-probability data were folded into the damage cases and AMORE runs were repeated assuming drug-abuse levels of 10%, 20%, 30%, and 40%. The impact on unit effectiveness is shown graphically at Figure 5-9 for Damage Cases 0 and 1, and Figure 5-10 for Damage Cases 2 and 3. These curves reflect the reconstituted unit effectiveness at the indicated drug-abuse levels. Two horizontal axes are shown. The top indicates the percentage of those personnel under age twenty-five that are assumed to be drug abusers. The bottom axis relates this percentage to the entire unit. Thus, twenty percent drug abuse of those susceptible relates to eleven percent for the entire unit. The level at which materiel limits unit effectiveness is shown by a dashed line.

The ability of the mechanized infantry headquarters company to support the battle was found to be limited only slightly by

Headquarters and Headquarters Company, Infantry
Bn (Mech)

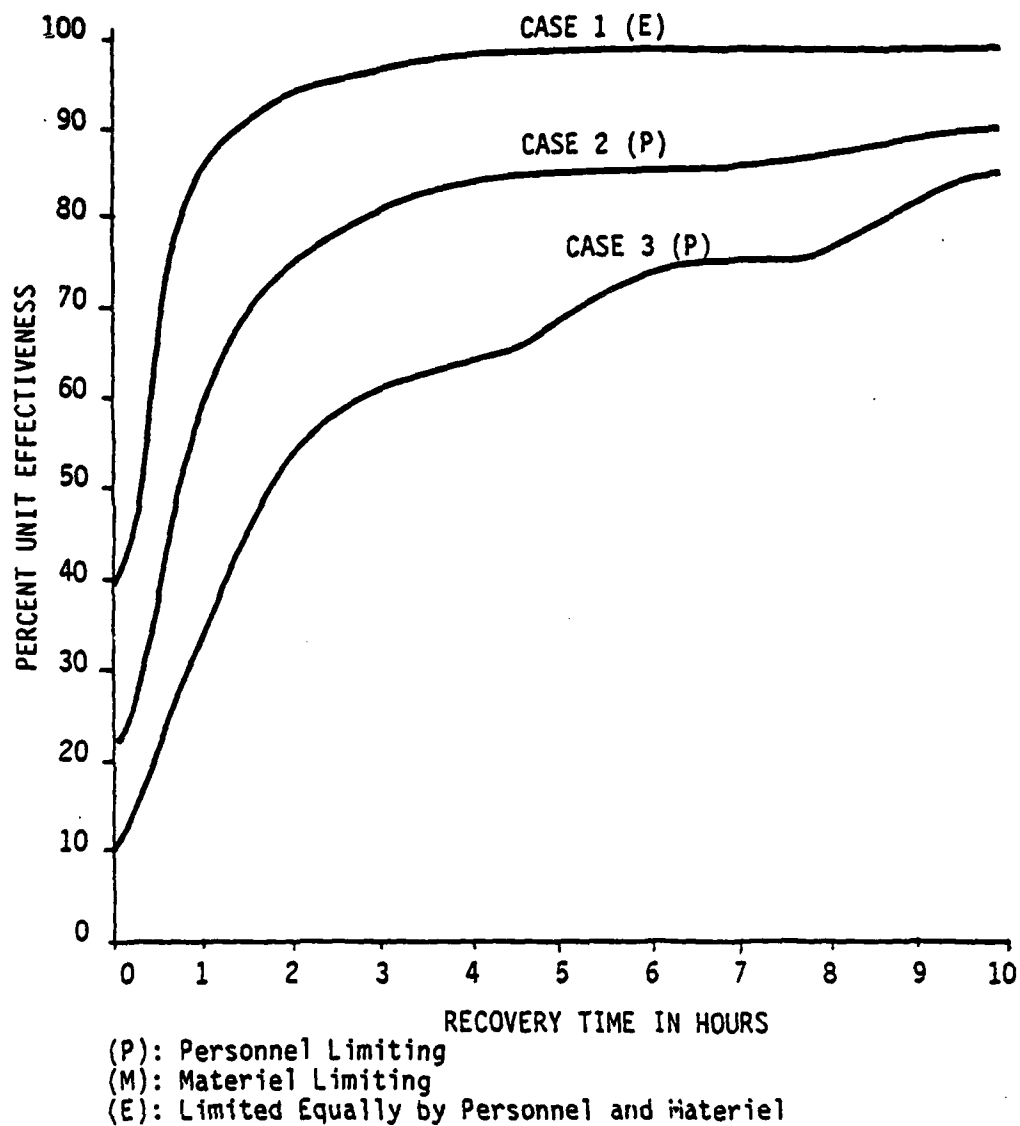


FIGURE 5-7. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE AT THREE LEVELS, HEADQUARTERS COMPANY, INFANTRY BATTALION (MECH).

HHC, INFANTRY BATTALION (MECH), BASE CASE.

MISSION ESSENTIAL PERSONNEL		CRITICAL PER. DAMAGE CASE		
TASK	NO.	1	2	3
RATT TH CH	26		X	X
RATT OP	28			X
COMMO CH	25		X	X
C-E MECH	27		X	X
WIRE SPEC	29			X
BN CDR	1			
LT VEH DVR	19			
BN EXEC/S-3	2			
HQ CDR	7			
STAFF SGT	13			
HQ CAR DVR	17			
INTEL OFF	22			
VEH DVR	33			
S-1,2,3,4	5			
CO DVR	12			
RTO	18			
SR ANALYST	23			
CLERK	16			

REQUIRED SUBSTITUTES		DAMAGE CASE		
TASK	NO.	1	2	3
C-E OFF	3	X	X	X
WIRE TH CHIEF	30			X

CRITICAL EQUIPMENT
NONE

FIGURE 5-8. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT FOR VARIOUS CASES OF COMBAT DAMAGE, HEADQUARTERS COMPANY, INFANTRY BATTALION (MECH).

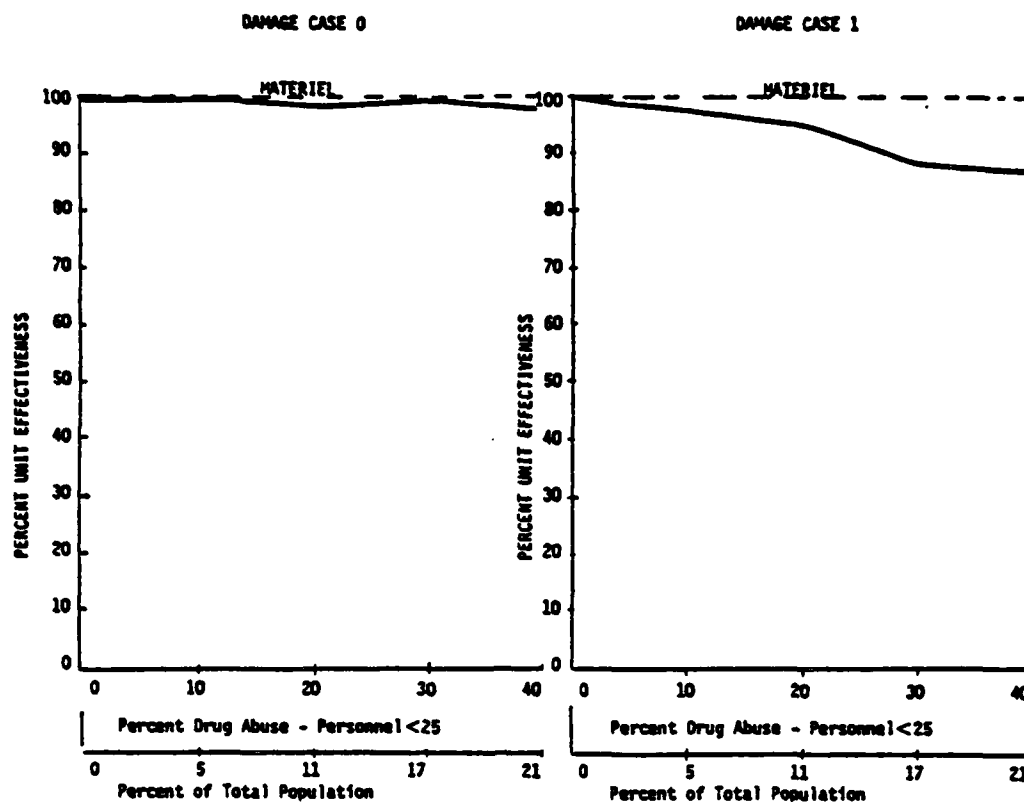


FIGURE 5-9. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE (CASES 0 AND 1) AND VARIOUS LEVELS OF DRUG ABUSE, HEADQUARTERS COMPANY, INFANTRY BATTALION (MECH).

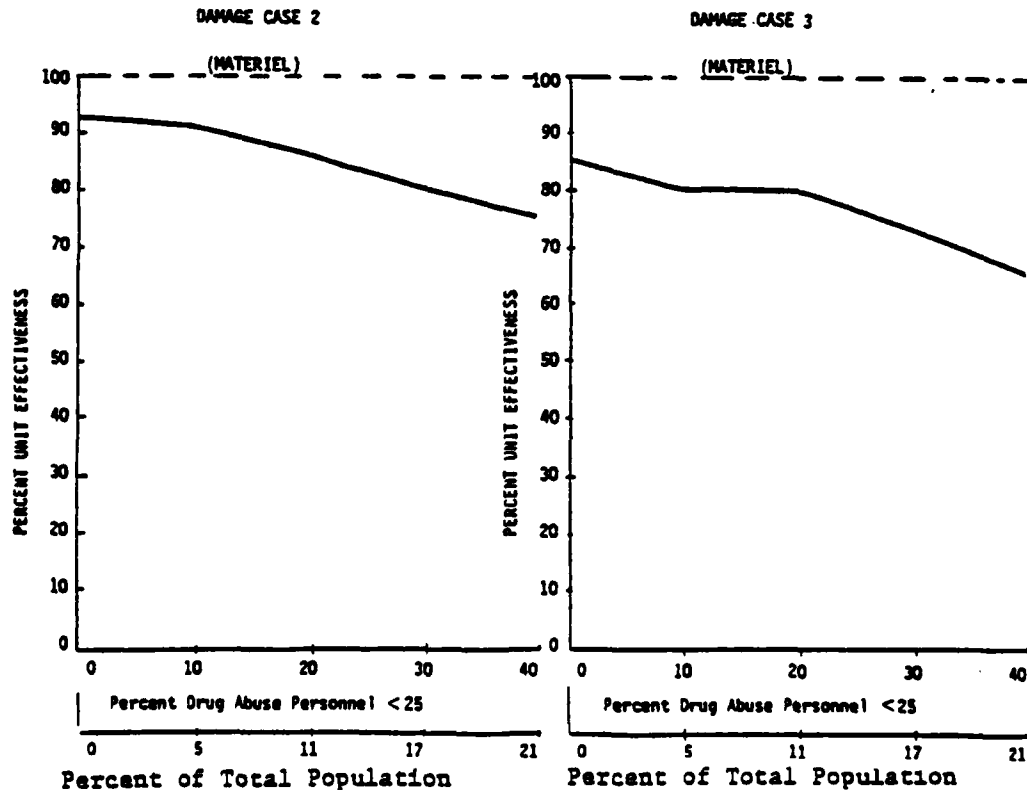


FIGURE 5-10. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE (CASES 2 AND 3) AND VARIOUS LEVELS OF DRUG ABUSE, HEADQUARTERS COMPANY, INFANTRY BATTALION (MECH).

increased drug usage at low combat damage levels. Only when combat losses reached levels of thirty percent did the additional losses from drug abuse have a significant effect on capability.

Critical personnel and required substitutes identified at the four drug-abuse levels are shown for each combat damage case in Figure 5-11 (Case 0), 5-12 (Case 1), 5-13 (Case 2), and 5-14 (Case 3). The addition of drug abuse surfaced the following positions as critical, in addition to those previously identified.

Battalion Commander
Battalion Exec/S-3
S-1, 2, 3, 4

No new required substitutes were identified.

One explanation for the headquarters company's apparently low risk to failure from drug abuse is the nature of its organization. A high degree of transferability exists for the essential functions, and most key positions are held by older personnel not likely to be involved in drugs.

DAMAGE CASE 0: HHC, INFANTRY BATTALION (MECH)

MISSION ESSENTIAL PERSONNEL		CRITICAL PERSON DRUG LEVEL				
TASK	NO	0	.1	.2	.3	.4
RATT TEAM CH	26			X		
RATT OPERATOR	28					
COMMO CHIEF	25					
C-E MECH	27			X		X
WIRE SPECIAL	29					X
BATTALION CDR	1					
LT VEH DVR	19					
BN EXEC/S-3	2					
HQ CDR	7					
STAFF SGT	13					
HQ CAR DVR	17					
INTEL OFF	22					
VEH DVR	33					
S-1/2/3/4	5					
CO DVR	12					
RTO	18					
SR ANALYST	23					
CLERK	16					

REQUIRED SUBSTITUTE		DRUG ABUSE LEVELS				
TASK	NO.	0	.1	.2	.3	.4
NONE						

CRITICAL EQUIPMENT	
NONE	

FIGURE 5-11. MISSION-LIMITING PERSONNEL FUNCTION AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE CASE 0, HEADQUARTERS COMPANY, INFANTRY BATTALION.

DAMAGE CASE 1: HHC, Infantry Battalion (Mech)

MISSION ESSENTIAL PERSONNEL		CRITICAL PERSONNEL DRUG LEVEL				
TASK	NO.	0	.1	.2	.3	.4
RATT TH CH	26				X	X
RATT OP	28				X	X
COMMO CH	25				X	X
C-E MECH	27		X	X	X	X
WIRE SPEC	29			X	X	X
BN CDR	1					
LT VEH DVR	19					
BN EXEC/S-3	2					
HQ CDR	7					
STAFF SGT	13					
HQ CARR. DVR	17					
INTEL OFF	22					
VEH DVR	33					
S-1/2/3/4	5					
CO DVR	12					
RTO	18					
SR. ANAL	23					
CLERK	16					

REQUIRED SUBSTITUTE		DRUG ABUSE LEVELS				
TASK	NO.	0	.1	.2	.3	.4
C-E OFFICER	3	X	X	X	X	X
WIRE TH CH	30			X	X	X

CRITICAL EQUIPMENT	
NONE	

FIGURE 5-12. MISSION-LIMITING PERSONNEL FUNCTION AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE CASE 1, HEADQUARTERS COMPANY, INFANTRY BATTALION.

DAMAGE CASE 2: HHC, Infantry Battalion (Mech)

MISSION ESSENTIAL PERSONNEL		CRITICAL PERSONNEL DRUG LEVEL				
TASK	NO.	0	.1	.2	.3	.4
RATT TM CH	26	X	X	X	X	X
RATT OP	28		X	X	X	X
COMM CH	25	X	X	X	X	X
C-E MECH	27	X	X	X	X	X
WIRE SP	29		X	X	X	X
BN CDR	1		X			
LT VEH DVR	19					
BN EXEC/S-3	2					
HQ CDR	7					
STAFF SGT	13					
HQ CARR DVR	17					
INTEL OFF	22					
VEH DVR	33					
S-1,2,3,4	5					
CO DVR	12					
RTO	18					
SR ANAL	23					
CLERK	16					

REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS				
TASK	NO.	0	.1	.2	.3	.4
CE OFF	3	X	X	X	X	X
WIRE TM CH	30		X		X	X

CRITICAL EQUIPMENT

HQ CARRIER

FIGURE 5-13. MISSION-LIMITING PERSONNEL FUNCTION AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE CASE 2, HEADQUARTERS COMPANY, INFANTRY BATTALION.

DAMAGE CASE 3: HHC, Infantry Battalion (Mech)

MISSION ESSENTIAL PERSONNEL		CRITICAL PERSONNEL DRUG LEVEL				
TASK	NO.	0	.1	.2	.3	.4
RATT TEAM CH	26	X	X	X	X	X
RATT OPERATOR	28	X	X	X	X	X
COMM CHIEF	25	X	X	X	X	X
C-E MECH	27	X	X	X	X	X
WIRE SPEC.	29	X	X	X	X	X
BATTALION CDR	1		X	X		
LT VEH DVR	19					
BN EXEC/S-3	2			X		
HQ CDR	7					
STAFF SGT	13					
CARR DVR	17					
INTEL OFF	22					
VEH DVR	33					
S-1/2/3/4	5				X	X
CO DVR	12					
RTO	18					
SR ANALYST	23					
CLERK	16					

REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS				
TASK	NO.	0	.1	.2	.3	.4
C-E OFF	3	X	X	X	X	X
WIRE TM CH	30		X		X	X

CRITICAL EQUIPMENT

NONE

FIGURE 5-14. MISSION-LIMITING PERSONNEL FUNCTION AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE CASE 3, HEADQUARTERS COMPANY, INFANTRY BATTALION.

SECTION III

COMBAT SUPPORT COMPANY INFANTRY BATTALION (MECHANIZED)

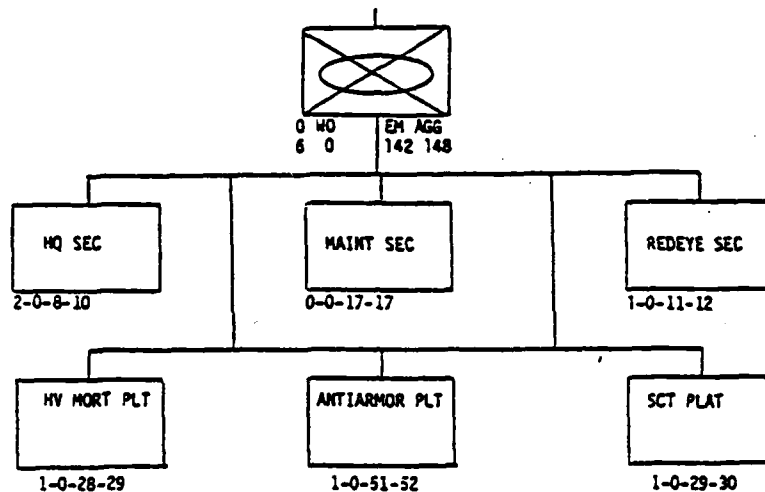
1. GENERAL

Combat Support (C/S) Company provides reconnaissance, ground surveillance, indirect fire support, antitank support and limited air defense support for all units assigned or attached to the mechanized infantry battalion. The C/S company is functionally organized as shown in Figure 5-15.

2. TEAM AND TRANSFER MATRICES

Personnel tasks identified for this analysis (listed by MOS) and the probability that personnel with this duty MOS are less than twenty-five years of age are contained in Table 5-3. Mission-essential teams were structured around the functional elements of the combat platoons, each element providing a slice of the unit's total capability. Twelve teams were constructed to accommodate the twelve TOW squads. Thus, each essential team has 1/12 of the primary antitank capability. The cumulative team build for personnel requirements is shown in Figure 5-16. A unique feature of C/S Company is that the unit headquarters performs a housekeeping function and has not operational responsibility for the combat platoons in the execution of their missions. The Scout Platoon is under operational control of the S-2 while the remaining platoons (RED EYE, Heavy Mortar and Anti-armor) are directed by the battalion S-3. Therefore, no essential personnel tasks are required from the headquarters or maintenance sections for the C/S Company to do its part in defending against a tank-heavy force. The requirement for two antitank gunners in team one reflects the operational concept of employing the weapons in pairs for maximum effectiveness. Transfers allowable between personnel tasks are shown in Figure 5-17. The clustering of transferability around the diagonal reflects the specialization in the platoons and limits substitution between sub-units.

Equipment requirements for the company's twelve essential teams are listed in Figure 5-18. Consideration similar to that given personnel determined which items and how many were needed for each additional increment of capability (team). Note the requirement for



COMBAT MISSION

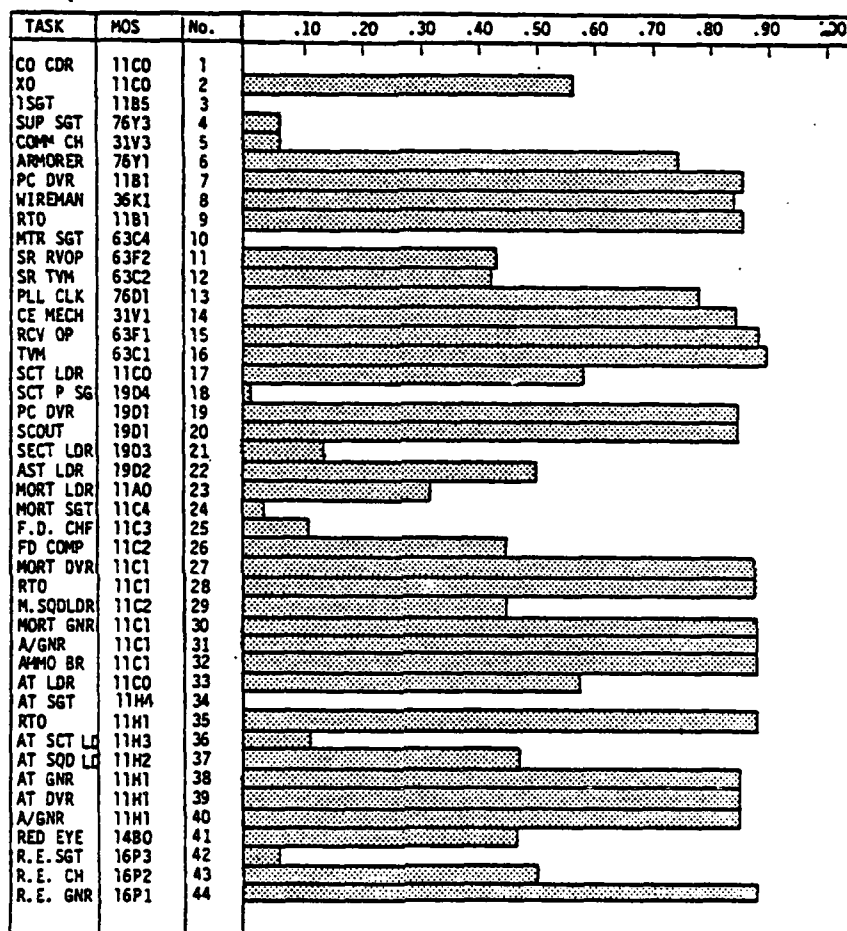
TO PROVIDE RECONNAISSANCE, GROUND SURVEILLANCE, INDIRECT FIRE SUPPORT, ANTITANK SUPPORT AND LIMITED AIR DEFENSE SUPPORT FOR THE INFANTRY BATTALION (MECH.)

ANALYSIS MISSION

TO PROVIDE COMBAT SUPPORT FOR THE INFANTRY BATTALION (MECH.) IN THE CONDUCT OF DEFENSIVE OPERATIONS AGAINST AN ARMOR HEAVY FORCE IN INTENSIVE COMBAT FOR A SHORT PERIOD OF TIME (24 HOURS).

FIGURE 5-15. COMBAT SUPPORT COMPANY, INFANTRY BATTALION (MECH)
TOE-7-48H-C15.

TABLE 5-3. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, COMBAT SUPPORT COMPANY, INFANTRY BATTALION (MECH).



TASK	MOS	NO	NUMBER OF PERSONNEL REQUIRED TO BUILD TEAMS											
			1	2	3	4	5	6	7	8	9	10	11	12
CO CDR	11C0	1												
XO	11C0	2												
1 SGT	11B5	3												
SUP SGT	76Y3	4												
COMM CH	31V3	5												
ARMORER	76Y1	6												
P.C. DVR	11B1	7												
WIREMAN	36K1	8												
RTO	11B1	9												
NTR SGT	63C4	10												
SR RVOP	63F2	11												
SR TVM	63C2	12												
PLL CLK	76D1	13												
CE MECH	31V1	14												
RCV OP	63F1	15												
TVM	63C1	16												
SCT LDR	11C0	17						1	1	1	1	1	1	1
SCT P. SGT	19D4	18												
PC DVR	19D1	19		2	2	2	5	5	5	7	7	8	10	10
SCOUT	19D1	20		1	2	3	4	5	6	7	8	9	10	10
SECT LDR	19D3	21		1	1	1	2	2	2	3	3	4	4	4
AST LDR	19D2	22		T	1	1	2	2	2	3	3	4	4	4
MORT LDR	11A0	23									1	1	1	1
MORT SGT	11C4	24								1	1	1	1	1
F. O. CHR	11C3	25								1	1	1	1	1
FD COMP	11C2	26		1	1	1	1	1	1	2	2	2	2	2
MORT DVR	11C1	27		1	1	2	3	3	3	4	4	4	5	5
RTO	11C1	28												1
M. SOD LDR	11C2	29			1	1	1	2	2	2	3	3	4	4
MORT GNR	11C1	30		1	1	1	2	2	2	3	3	3	4	4
A/ GNR	11C1	31				1	1	1	2	2	2	3	4	4
AMMO BR	11C1	32										2	4	4
AT LDR	11C0	33									1	1	1	1
AT SGT	11H4	34					1	1	1	1	1	1	1	1
RTO	11H1	35											1	2
AT SCT LDR	11H3	36		1	1	2	2	3	3	4	4	5	5	6
AT SOD LDR	11H2	37		1	1	2	2	3	3	4	4	5	5	6
AT GNR	11H1	38		2	2	4	4	6	6	8	8	10	11	12
AT DVR	11H1	39		1	2	3	4	5	6	7	8	9	10	11
A/GNR	11H1	40									2	4	8	12
RED EYE	14B0	41									1	1	1	1
RE SGT	16P3	42					1	1	1	1	1	1	1	1
RE CH	16P2	43			1	1	2	2	3	3	4	4	5	5
RE GNR	16P1	44		1	1	2	2	3	3	4	4	5	5	5

FIGURE 5-16. CUMULATIVE TEAM REQUIREMENTS, PERSONNEL, COMBAT SUPPORT COMPANY, INFANTRY BATTALION (MECH).

[illegible]

FIGURE 5-17. TRANSFER MATRIX, PERSONNEL, COMBAT SUPPORT COMPANY, INFANTRY BATTALION (MECH).

EQUIPMENT REQUIRED TO BUILD TEAMS												
SECTION	ITEM	AUTH	1	2	3	4	5	6	7	8	9	10 11 12
HQ	APC, VRC 47	2										
	1/2 TRK	1										
	2 1/2 TRK	1										
MAINT	1 1/2 TRK	1										
	2 1/2 TRK	1										
	REC. VEH	1										
SCOUT	APC, VRC 12	1										1 1 1
	APC, VRC 47	1										1 1 1
	APC, GRC160	8				2 2 2	4 4 4	6 6 6				8 8 8
MORT	APC, FDC	1				1 1 1	1 1 1	1 1 1				1 1 1
	1/2 TRK	1							1 1 1			1 1 1
	4.2 MORT	4				1 1 1	2 2 2	3 3 3				4 4 4
	MORT, CAR	4				1 1 1	2 2 2	3 3 3				4 4 4
ANTITANK	1/2 TRK	2						1 1 1	1 1 1			2 2 2
	T.O.W.	12				2 2 2	4 4 4	6 6 6	8 8 8	9 9 9	10 10 10	11 11 11
	TOW CARR	12				1 2 3	4 5 6	7 8 9				10 11 12
RED EYE	1/2 TRK, GRA39	1						1 1 1	1 1 1			1 1 1
	1/2 TRK, GRC160	5				1 1 2	2 3 3	4 4 4				5 5 5

FIGURE 5-18. CUMULATIVE TEAM REQUIREMENTS, MATERIEL, COMBAT SUPPORT COMPANY, INFANTRY BATTALION (MECH).

1	0	0	0	30	0	-1	30	0	30	0	0	-1	-1	0	-1	-1	-1	-1
2	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	0	-1	-1	30	30
3	-1	-1	0	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
4	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
5	-1	-1	0	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
6	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
7	30	-1	0	30	-1	-1	0	30	30	30	-1	-1	-1	-1	-1	-1	-1	-1
8	0	0	0	30	0	-1	30	0	30	30	-1	-1	-1	0	-1	-1	-1	-1
9	30	-1	-1	-1	0	-1	30	30	0	30	-1	-1	-1	-1	-1	-1	-1	-1
10	0	0	0	30	0	-1	30	0	30	0	0	-1	-1	0	-1	-1	-1	-1
11	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	0	-1	-1	30	30
12	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1
13	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1
14	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	0	-1	-1	30	30
15	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1
16	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1
17	-1	30	-1	-1	-1	-1	-1	-1	-1	-1	30	-1	-1	30	-1	-1	0	0
18	-1	30	-1	-1	-1	-1	-1	-1	-1	-1	30	-1	-1	30	-1	-1	30	0
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

FIGURE 5-19. TRANSFER MATRIX, MATERIEL, COMBAT SUPPORT COMPANY, INFANTRY BATTALION (MECH).

two TOWs in team one, to match the two TOW gunners required for personnel in team one. At fifty percent effectiveness, the C/S Company requires four of the eight armored carriers for the Scout Section, two of its four mortars, six of twelve TOWs, and just over half the RED EYE weapons carriers. Substitutability, as shown in Figure 5-19, between items of equipment, reflects the specialization of each platoon. A TOW carrier (item sixteen), for example, is unique in that it is also the launcher for the mounted weapon. No other carrier can perform the launch function. The mortar carrier also serves as a firing platoon for its tube. Other carriers are interchangeable, however, with only minor time penalties to transfer equipment.

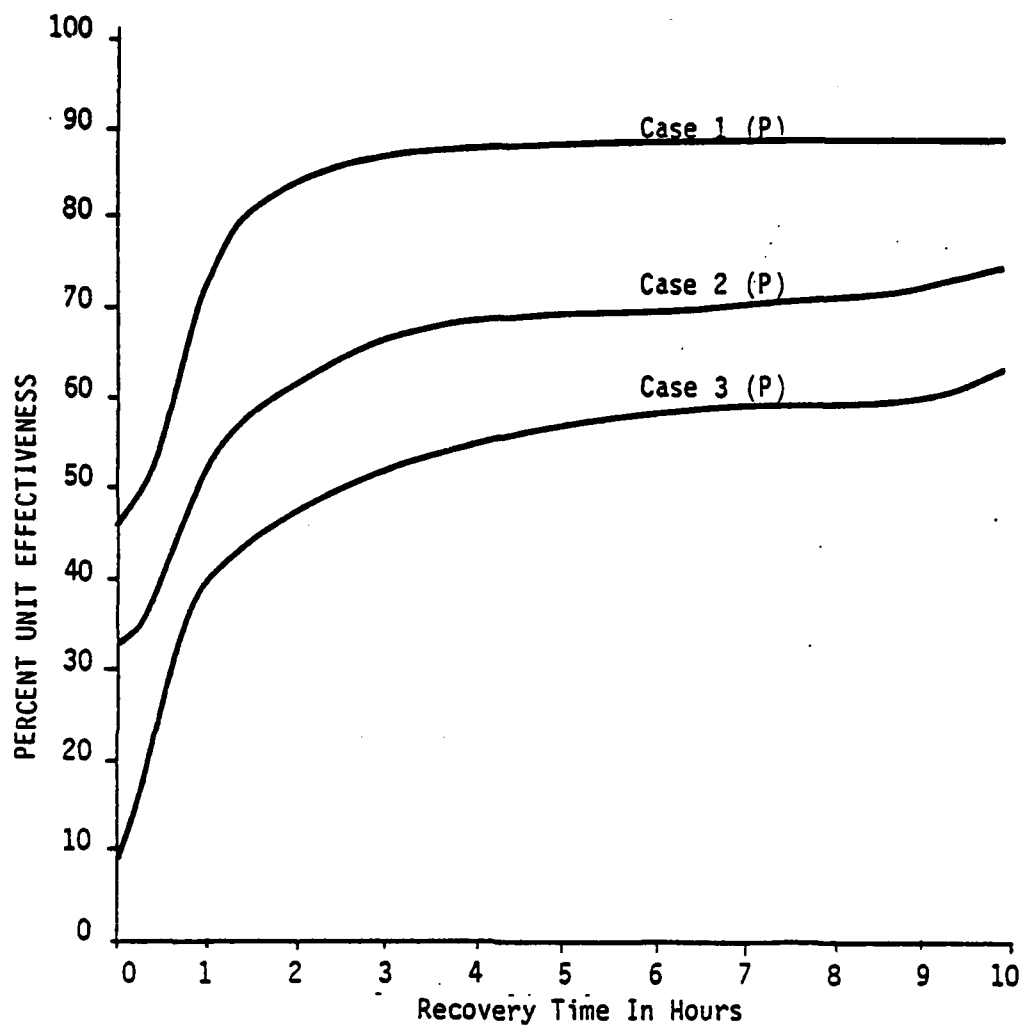
3. RESULTS

AMORE runs were made for the three Damage Cases (1, 2, and 3) described in Table 5-1, using the input data described above. No drug-abuse degradation was considered at this point. The resultant unit effectiveness as a function of time is plotted for these damage cases at Figure 5-20. At Damage Case 1, C/S Company recovered approximately ninety percent of its effectiveness in five hours. As damage levels increased, its rate of recovery decreased. Its maximum capability of sixty-five percent was not reached until about ten hours in Damage Case 3. Effectiveness was limited by personnel shortages in all cases.

The personnel functions and materiel items which limited the unit's effectiveness for the three damage cases are listed at Figure 5-21. Examination of these lists points out the importance of the antitank functions to unit effectiveness. Three of the top seven personnel functions are antitank related. The lack of required substitutes highlights the lack of transferability between functions.

The AMORE runs were repeated assuming drug-usage levels of 10%, 20%, 30%, and 40% for each of the four damage cases. The resultant unit effectiveness (assuming a drug user was ineffective and less than twenty-five years of age) is shown graphically at Figure 5-22 for damage cases zero and one, and Figure 5-23 for damage cases two and three. Each curve shows the reconstituted unit effectiveness at each drug-abuse level. Two drug-usage scales are shown. The top axis reflects the percentage of those persons, under twenty-five, who are assumed to be drug abusers. The bottom scale relates this to total unit population. For example, thirty percent of those under twenty-five equals twenty-one percent of the total unit population.

Combat Support Company, Infantry Bn (Mech)



(P): Personnel Limited

(M): Materiel Limited

(E): Limited Equally by Personnel and Materiel

FIGURE 5-20. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE AT THREE LEVELS, COMBAT SUPPORT COMPANY, INFANTRY BATTALION (MECH).

C/S Company, Infantry Battalion (Mech), Base Case

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS. DAMAGE CASE		
TASK	NO.	1	2	3
AT GNR	38	X	X	X
AT SQD LDR	37	X	X	X
RED EYE GNR	44	X	X	X
RED EYE TN CH	43	X	X	X
AT SECT LDR	36	X	X	X
A/SECT LDR	22	X	X	X
RED EYE SGT	42	X	X	X
SCOUT SECT LDR	21	X		X
MORT GNR	30		X	
MORT P. SGT	24			X
F.D. COMP.	26			X
AT PLT LDR	33			X
AST MORT GNR	31		X	
SCT PLAT LDR	17			X
MORT PLT LDR	23		X	
F.D. CHIEF	25			X
SCOUT	20		X	
AT PLT SGT	34			
A.T. DVR	39			
MORT DVR	27			
SCT DVR	19			
MORT SQD LDR	29			
RE SECT LDR	41			
ASST AT GNR	40			
SCT PLT SGT	18			
AMMO BEAR	32			
AT RTO	35			
MORT RTO	28			

REQUIRED SUBSTITUTES		DAMAGE CASE		
TASK	NO.	1	2	3
NONE				

CRITICAL EQUIPMENT			
ITEM	DAMAGE CASE		
	1	2	3
TOW	X	X	X
4.2 MORTAR	X	X	X
MORT CARRIER	X	X	X
TOW CARRIER	X	X	X
SCOUT CARRIER		X	X
RED EYE 4TRK			X

FIGURE 5-21. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF COMBAT DAMAGE, COMBAT SUPPORT COMPANY, INFANTRY BATTALION (MECH).

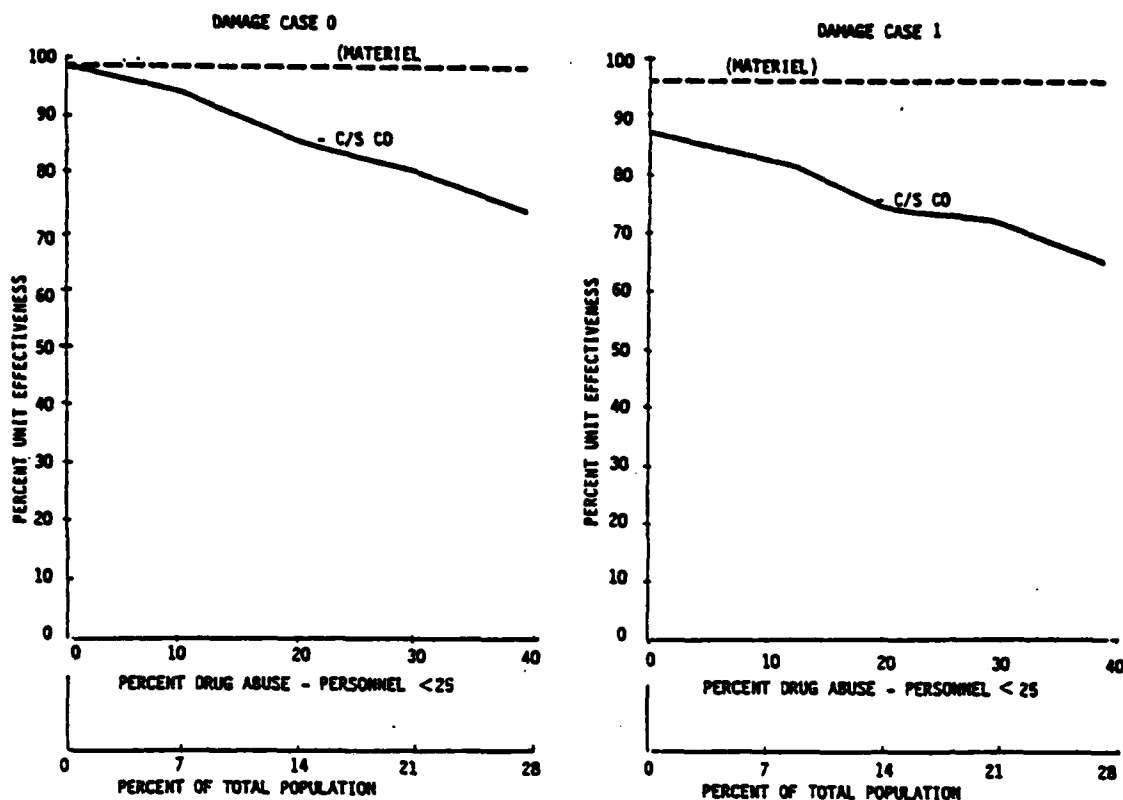


FIGURE 5-22. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE (LEVELS 0 AND 1) AND VARIOUS LEVELS OF DRUG ABUSE, COMBAT SUPPORT COMPANY, INFANTRY BATTALION (MECH).

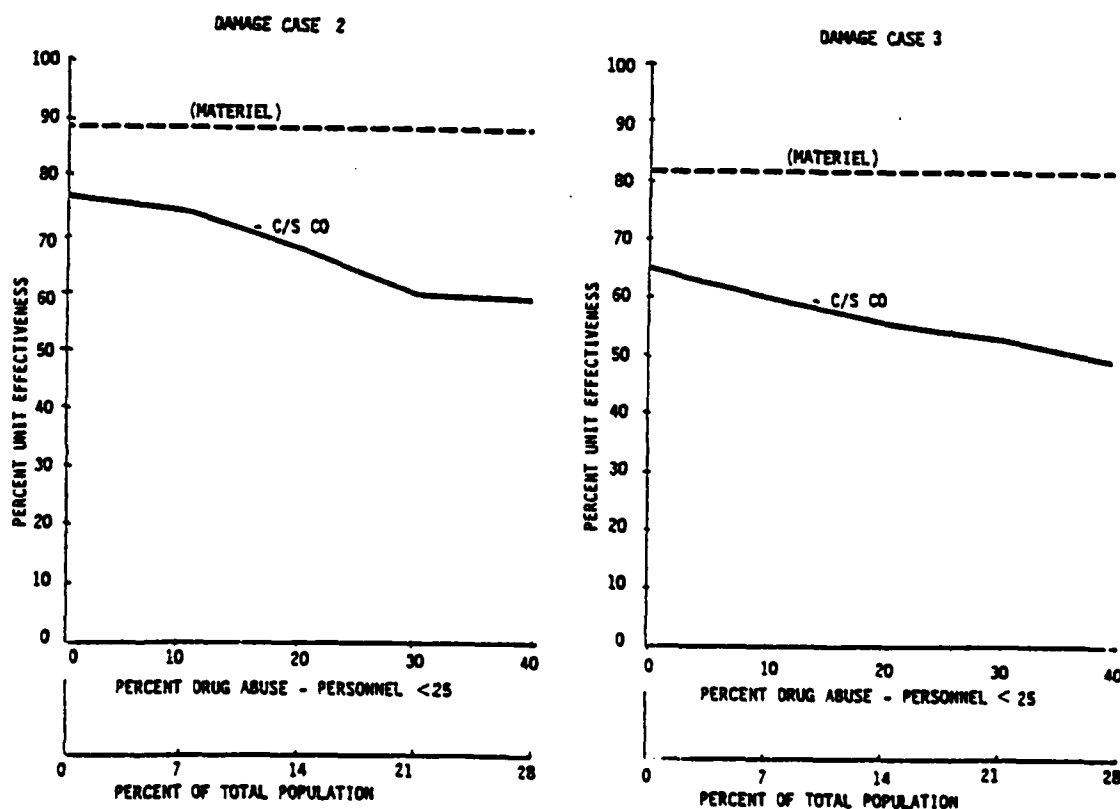


FIGURE 5-23. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE (LEVELS 2 AND 3) AND VARIOUS LEVELS OF DRUG ABUSE, COMBAT SUPPORT COMPANY, INFANTRY BATTALION (MECH)

The percent of unit effectiveness limited by materiel is shown as a dashed line.

The combat support company's unit effectiveness decreases sharply with increased drug-abuse levels for most damage cases. This is particularly evident at the zero combat damage cases, where effectiveness falls twenty-five percent for a drug abuse level of forty percent (twenty-eight percent of total unit population).

Critical personnel and required substitutes identified at the four drug-abuse levels are shown for each combat damage case in Figures 5-24 (Damage Case 0), 5-25 (Case 1), 5-26 (Case 2) and 5-27 (Case 3). The compounding effect of drug abuse on effectiveness identified six additional critical personnel functions beyond the seventeen functions previously identified in the base case run. They are:

- Antitank Platoon Sergeant
- Antitank Carrier Driver
- Scout Driver
- Mortar Squad Leader
- RED EYE Section Leader
- Assistant Antitank Gunner

As before, no non-essential positions were required to substitute for critical functions.

The relatively high risk to drug abuse in C/S company is related to the lack of substitutability between essential functions and key tasks being performed by younger personnel.

Damage Case 0, C/S Co., Infantry Battalion (Mech)

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS				
		DRUG LEVEL				
TASK	NO.	.0	.1	.2	.3	.4
AT GNR	38		X	X	X	X
AT SQD LDR	37		X	X	X	X
RED EYE GNR	44		X	X	X	X
RED EYE TM CH	43		X	X	X	X
AT SECT LDR	36			X	X	X
A/SECT LDR	22		X	X	X	X
RED EYE DOT	42					
SCOUT SECT LDR	21					
MORT GNR	30				X	X
MORT P SGT	24					
F.D. COMP	26				X	
AT PLT LDR	33					
AST MORT GNR	31				X	X
SCT PLAT LDR	17					
MORT PLT LDR	23					
FD CHIEF	25					
SCOUT	20				X	X
AT PLT SGT	34					
AT DVR	39					
MORT DVR	27					
SCT DVR	19					X
MORT SQD LDR	29				X	X
RE SECT LDR	41					
ASST AT GNR	40				X	X
SCT PLT SGT	18					
AMMO BEAR	32					
AT RTO	35					
MORT RTO	28					

REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS				
TASK	NO.	0	1	2	3	4
NONE						

CRITICAL EQUIPMENT
NONE

FIGURE 5-24. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE, CASE 0, COMBAT SUPPORT COMPANY, INFANTRY BATTALION (MECH).

Damage Case 1, C/S Company, Infantry Battalion (Mech)

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS.				
		DRUG LEVEL				
TASK	NO.	.0	.1	.2	.3	.4
AT GNR	38	X	X	X	X	X
AT SQD LDR	37	X	X	X	X	X
RED EYE GNR	44	X	X	X	X	X
RED EYE TM CH	43	X	X	X	X	X
AT SECT LDR	36	X	X	X	X	X
A/SECT LDR	22	X	X	X	X	X
RED EYE SGT	42	X				
SCOUT SECT LDR	21	X	X		X	
MORT GNR	30			X	X	X
MORT P. SGT	24					
F.D. COMP	26		X	X		X
AT PLAT	33					X
AST MORT GNR	31					
SCT PLAT LDR	17					
MORT PLT LDR	23					
F.D. CHIEF	25					X
SCOUT	20			X	X	
AT PLT SGT	34					
A.T. DVR	39		X			
MORT DVR	27					
SCT DVR	19					
MORT SQD LDR	29		X			
RE SECT LDR	41					
ASST AT GNR	40			X	X	
SCT PLT SGT	18					
AMMO BEAR	32					
AT RTO	35					
MORT RTO	28					

REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS				
TASK	NO.	0	1	2	3	4
NONE						

CRITICAL EQUIPMENT
T.O.W. 4.2 MORTAR MORTAR CARRIER TOW CARRIER

FIGURE 5-25. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE, CASE 1, COMBAT SUPPORT COMPANY, INFANTRY BATTALION (MECH).

Damage Case 2, C/S Company, Infantry Battalion (Mech)

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG LEVEL					REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS				
TASK	NO.	0	1	2	3	4	TASK	NO.	0	1	2	3	4
AT GNR	38	X	X	X	X	X	NONE						
AT SQD LDR	37	X	X	X	X	X							
RED EYE GNR	44	X	X	X	X	X							
RED EYE TN CH	43	X	X	X	X	X							
AT SECT LDR	36	X	X	X	X	X							
A/SECT SGT	22	X	X	X	X	X							
RED EYE SGT	42	X		X									
SCOUT SECT LDR	21				X								
MORT GNR	30	X	X	X		X							
MORT P. SGT	24												
F.D. COMP	26		X			X							
AT PLT LDR	33												
AST MORT GNR	31	X			X								
SCT PLAT LDR	17												
MORT PLT LDR	23	X	X										
F.D. CHIEF	25					X						X	X
SCOUT	20	X		X		X							
AT PLT SGT	34		X										
AT DVR	39												
MORT DVR	27												
SCT DVR	19		X										
MORT SQD LDR	29		X			X							
RE SECT LDR	41												
ASST AT GNR	40		X										
SCT PLT SGT	18												
AMMO BEAR	32												
AT RTO	35												
MORT RTO	28												

CRITICAL EQUIPMENT	
T.O.W.	
4.2 MORTAR	
TOW CARRIER	
MORTAR CARRIER	
SCOUT CARRIER	

FIGURE 5-26. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE, CASE 2, COMBAT SUPPORT COMPANY, INFANTRY BATTALION (MECH).

Damage Case 3, C/S Company, Infantry Battalion (Mech)

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS. DRUG LEVEL					REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS				
TASK	NO.	0	1	2	3	4	TASK	NO.	0	1	2	3	4
AT GNR	38	X	X	X	X	X	NONE						
AT SQD LDR	37	X	X	X	X	X							
RED EYE GNR	44	X	X	X	X	X							
RED EYE TN CH	43	X	X	X	X	X							
AT SECT LDR	36	X	X	X	X	X							
A/SECT LDR	22	X	X	X	X	X							
RED EYE SGT	42	X		X									
SCOUT SECT LDR	21	X		X									
MORT GNR	30			X		X							
MORT P. SGT	24	X		X		X							
F.D. COMP	26	X	X	X		X							
AT SECT LDR	33	X				X							
AST PLT LDR	31			X		X							
SCT PLAT LDR	17	X		X									
MORT PLT LDR	23		X	X									
F.D. CHIEF	25	X		X		X							
SCOUT	20			X	X	X							
AT PLT SGT	34		X										
AT DVR	39					X							
MORT DVR	27												
SCT DVR	19					X							
MORT SQD LDR	29			X									
RE SECT LDR	41												
ASST AT GNR	40												
SCT PLT SGT	18												
AMMO BEAR	32												
AT RTO	35												
MORT RTO	28												

CRITICAL EQUIPMENT	
T.O.W.	
4.2 MORTAR	
MORTAR CARRIER	
TOW CARRIER	
SCOUT CARRIER	
RED EYE 4TRK	

FIGURE 5-27. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE, CASE 3, COMBAT SUPPORT COMPANY, INFANTRY BATTALION (MECH).

SECTION IV
RIFLE COMPANY
INFANTRY BATTALION (MECHANIZED)

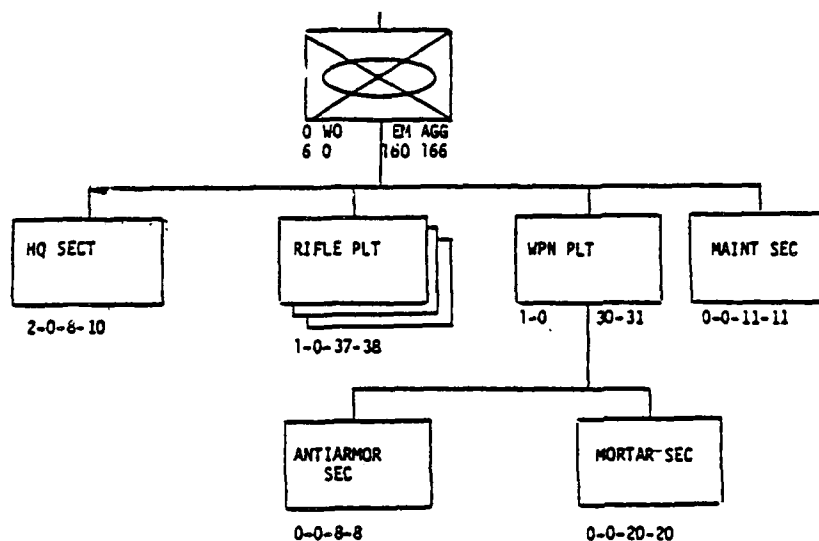
1. GENERAL

The primary operations arm of the infantry battalion is the rifle company. It is the principal maneuver unit that closes with and engages the enemy in close combat. The rifle company is functionally organized as shown in Figure 5-28.

2. TEAMS AND TRANSFER MATRICES

A total of thirty-nine personnel functions were considered for analysis and are listed in Table 5-4 (by MOS) along with the probability that the MOS is occupied by a person less than twenty-five years of age. Mission-essential teams were built around the smallest combat element, the fire team in each rifle squad. Thus, the company was structured for AMORE analysis around eighteen fire teams. Other personnel functions contributed as required to each team to provide an increment of equal effectiveness. The personnel team structure for the rifle company to perform its basic combat mission is shown at Figure 5-29. Entries in each column indicate the total personnel required to build that many teams for example, to build ten teams (fifty-six percent of total effectiveness), requires ten fire teams (five squads), some mortar capability, and antitank personnel, together with the command and control necessary for about one-half the company to function. Supply, maintenance and administrative functions are not essential to fighting for a short period of time and are not required in any of the teams. Transfers allowable among functions are shown in Figure 5-30. The numerous entries in columns twenty through twenty-six (rifle squad functions) reflect the high degree of substitutability for these basic combat skills common to all soldiers.

Equipment is assigned to teams similarly to personnel and is shown in Figure 5-31. As a new squad is formed, for example, at team three, another APC is required. Note that to build ten teams requires eight APCs (other than weapons platoons); five for the rifle squads, two for each platoon headquarters, and one for the company commander. Allowed substitutions for equipment are shown in the transfer matrix at Figure 5-32. Note that APC's can generally substitute for each



COMBAT MISSION

TO CLOSE WITH THE ENEMY BY MEANS OF FIRE AND MANEUVER IN ORDER TO DESTROY OR CAPTURE HIM OR TO REPEL HIS ASSAULT BY FIRE, CLOSE COMBAT AND COUNTERATTACK.

ANALYSIS MISSION

DEFEND AGAINST AN ARMOR HEAVY FORCE IN AN INTENSIVE COMBAT SITUATION FOR A SHORT PERIOD OF TIME (24 HOURS).

FIGURE 5-28. RIFLE COMPANY, MECHANIZED INFANTRY BATTALION, TOE-7-47H0-C16.

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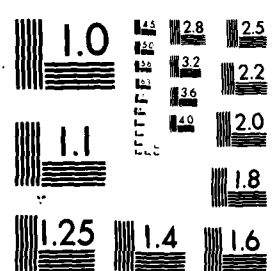
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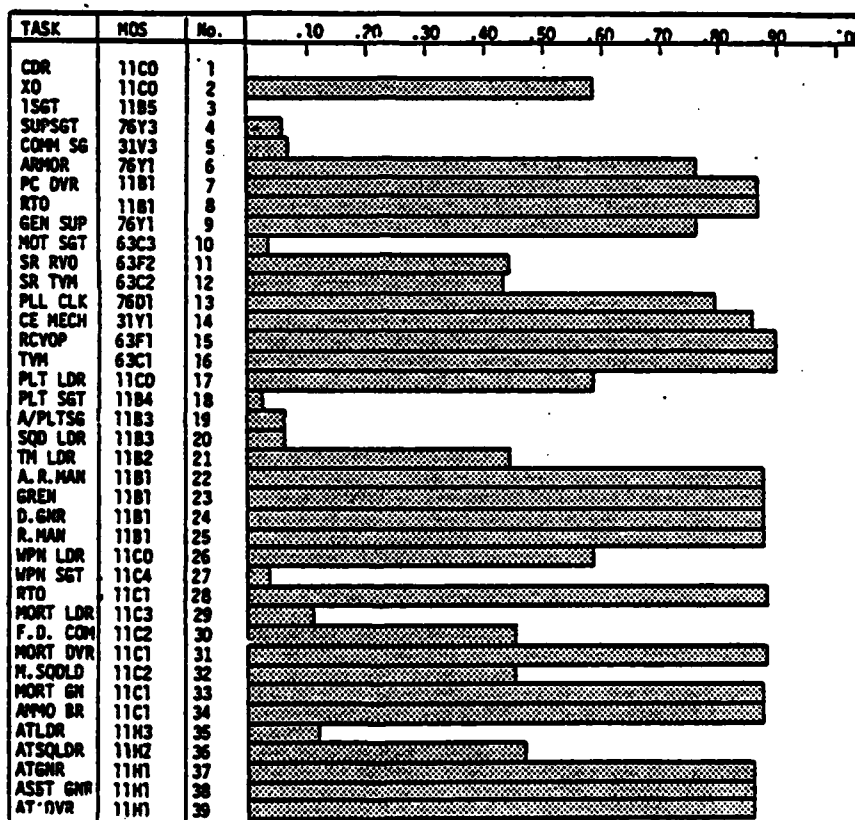
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TABLE 5-4. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, RIFLE COMPANY, INFANTRY BATTALION (MECH).



NUMBER OF PERSONNEL REQUIRED TO BUILD TEAMS																				
TASK	MOS	NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
CDR	11C0	1										1	1	1	1	1	1	1	1	1
XO	11C0	2																		
1SGT	11B5	3																		
SUP SGT	76Y3	4																		
COMM SGT	31V3	5																1	1	1
ARMOR	76Y1	6																		
PC DVR	MB1	7																		
RTO	11B1	8	1	2	3	4	4	5	5	6	8	9	9	10	10	11	11	12	14	
GEN SUP	76Y1	9						1	1	1	1	1	1	2	2	2	2	3	4	
MOT SGT	63C3	10																		
SR RVO	63F2	11																		
SR TVH	63C2	12																		
PLL CLK	76K1	13																		
CE MECH	31V1	14																		
RCVOP	63F1	15																		
TVH	63C1	16																		
PLT LDR	11C0	17					1	1	1	1	1	1	2	2	2	2	2	2	3	3
PLT SGT	11B4	18				1	1	1	1	1	1	2	2	2	2	2	2	3	3	3
PLT SGT	11B4	19				1	1	1	1	2	2	2	2	2	2	2	2	3	3	3
SQD LDR	11B3	20	1	1	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	9
TH LDR	11B2	21	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
AR MAN	11B1	22	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
GRN	11B1	23	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
D. GNR	11B1	24	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9
R. MAN	11B1	25	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
MPN LDR	11C0	26													1	1	1	1	1	1
MPN SGT	11C4	27												1	1	1	1	1	1	1
RTO	11C1	28															1	1	2	2
MORT LDR	11C3	29															1	1	1	1
FD COM	11C2	30							1	1	1	1	1	1	2	2	2	2	2	2
MORT DVR	11C1	31							1	1	1	1	1	1	1	2	2	2	3	4
H.SQD LDR	11C2	32							1	1	1	1	1	2	2	2	2	3	3	3
MORT GNR	11C1	33							1	1	1	1	2	2	2	3	4	4	5	6
AMMO BR	11C1	34															1	1	2	3
AT LDR	11A3	35											1	1	1	1	1	1	1	1
AT SQDLDR	11H2	36						1	1	1	1	1	1	1	1	1	1	1	1	1
AT GNR	11H1	37						1	1	1	1	1	1	2	2	2	2	2	2	2
ASST GNR	11A1	38								1	1	1	1	1	1	1	2	2	2	2
AT DVR	11A1	39										1	1	1	1	1	2	2	2	2

FIGURE 5-29. CUMULATIVE TEAM REQUIREMENTS, PERSONNEL RIFLE COMPANY, INFANTRY BATTALION (MECH).

EQUIPMENT REQUIRED TO BUILD TEAMS

SECT	EQUIP	AUTH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
HQ	APC	2										1	1	1	1	1	1	2	2	2
	4TRK	1																		
	24TRK	1																		
MAINT	24TRK	2																		
	REV VEH	1																		
PLAT	APC LDR	3				1	1	1	1	1	1	2	2	2	2	2	2	3	3	3
	APC SQD	9	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9
MPHS	4TRK	1													1	1	1	1	1	1
	4TRK	1															1	1	1	1
	MORT	3							1	1	1	1	2	2	2	2	3	3	3	3
	APC	4							1	1	1	1	1	1	1	2	2	2	3	4
	TOW	2						1	1	1	1	1	1	2	2	2	2	2	2	2
	APC	2										1	1	1	1	1	2	2	2	2

FIGURE 5-31. CUMULATIVE TEAM REQUIREMENTS, MATERIEL RIFLE COMPANY, INFANTRY BATTALION (MECH).

1	0	0	0	0	-1	30	30	-1	-1	-1	-1	-1	-1
2	-1	0	-1	-1	-1	-1	-1	0	0	-1	-1	-1	-1
3	-1	30	0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1
4	-1	30	0	0	-1	-1	-1	-1	-1	-1	-1	-1	-1
5	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1
6	30	30	30	30	-1	0	0	-1	-1	-1	-1	-1	-1
7	30	30	30	30	-1	0	0	-1	-1	-1	-1	-1	-1
8	-1	0	-1	-1	-1	-1	-1	0	0	-1	-1	-1	-1
9	-1	30	-1	-1	-1	-1	-1	15	0	-1	-1	-1	-1
10	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1
11	30	30	30	30	-1	30	30	0	0	-1	0	-1	-1
12	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1
13	30	30	30	30	-1	30	30	0	0	-1	-1	-1	0
	1	2	3	4	5	6	7	8	9	10	11	12	13

FIGURE 5-32. TRANSFER MATRIX, MATERIEL, RIFLE COMPANY, INFANTRY BATTALION (MECH).

other with an occasional time penalty to remount equipment. For example, the rifle platoon headquarters APC (item six) can, if required, be used as the unit commander's vehicle (item one) after thirty minutes to permit transfer of the radio required for company communications. No time penalty is assessed for the platoon APC (item six) to be used as a rifle squad carrier (item seven). Also of interest is the mortar carrier (item eleven). Its function as a firing platform cannot be assumed by other APCs. The mortar can, of course, be operated from the ground in a dismounted mode.

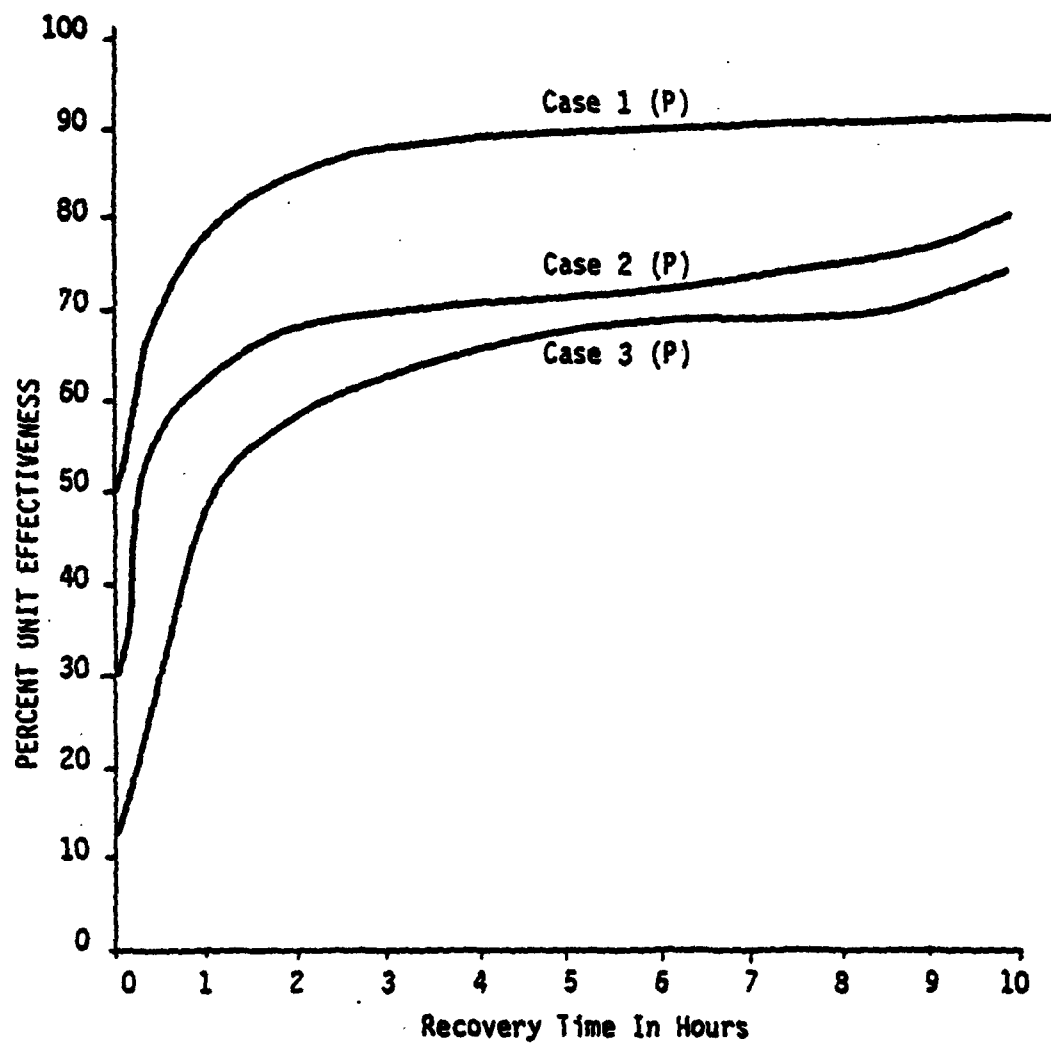
3. RESULTS

The input described above was used to evaluate the unit's effectiveness as a function of time at three damage levels, Cases 1, 2, and 3. The combinations of casualty losses and equipment damage probabilities for each of these cases is described in Table 5-1. No drug-abuse degradation was assumed for these runs. The curves at Figure 5-33 show how the rifle company was able to reconstitute its effectiveness following each level of personnel degradation and equipment losses as a function of time. The unit's effectiveness is limited by personnel degradation in all cases. At Damage Case 1 (ten percent personnel casualties), the rifle company recovered better than ninety percent of its effectiveness. At Case 3 the unit still recovered to about seventy-five percent.

Personnel functions and materiel items which limited unit effectiveness for these damage cases are listed in Figure 5-34, along with those non-essential functions required to substitute for critical shortages. That twenty-one of twenty-six mission essential functions are critical indicates the high degree of substitutability between positions and uniformity of requirements for these functions as each new team is built. The high degree of substitutability is also indicated by the relatively large number (ten) of substitutes required to replace critical personnel shortages.

The AMORE runs were repeated adding degradation from drug abuse assuming levels of 10%, 20%, 30%, and 40%. It was further assumed that the probability of being a casualty from drug abuse equaled the product of the probability of being less than twenty-five years of age and the assumed drug-abuse level. Unit effectiveness curves for degradation due to drug abuse are shown for each damage case as a function of drug abuse at Figure 5-35 (Damage Cases 0 and 1) and Figure 5-36 (Damage Cases 2 and 3). Two drug usage scales are shown. The top axis reflects the percentage of those persons under

Rifle Company, Infantry Battalion (Mech)



(P): Personnel Limited
(M): Materiel Limited
(E): Limited Equally by Personnel and Materiel.

FIGURE 5-33. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE AT THREE LEVELS, RIFLE COMPANY, INFANTRY BATTALION (MECH).

RIFLE COMPANY, INFANTRY BATTALION (MECH), BASE CASE

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS.		
		DAMAGE CASE		
TASK	NO	1	2	3
AT SQD LDR	36	X	X	X
FD COMP	30	X	X	X
AST PLT SGT	19	X	X	X
DGN GNR	24	X	X	X
FIRE TM LDR	21	X	X	X
AT GNR	37	X	X	X
MORT SQD LDR	32	X	X	X
CO CDR	1	X	X	X
RIFLE SQD LDR	20	X	X	X
COMM SGT	5	X	X	X
AT SECT LDR	35	X	X	X
MORT SECT LDR	27	X	X	X
MORT GNR	33	X	X	X
RIFLE PLT SGT	18	X	X	X
GREN	23	X	X	X
AR MAN	22	X	X	X
MORT SECT LDR	29			X
MORT CAR DVR	31	X		
RIFLE PLT LDR	17	X		
WPN PLT LDR	26		X	
APC DVR	7	X		
RIFLEMAN	25			
ASST ATGNR	39			
AT DVR	38			
CO RTO	8			
WPN PLT RTO	28			
AMMO BEARER	34			

REQUIRED SUBSTITUTES		DAMAGE LEVEL		
TASK	NO	1	2	3
EXEC OFF	2	X	X	X
1SGT	3	X	X	X
ARMORER	6		X	X
SUPPLY CLK	9	X	X	X
SR REC VEH OP	11	X	X	X
SR TVM	12	X	X	X
PLL CLK	13	X	X	X
C-E MECH	14	X	X	X
REC VEH OP	15	X	X	X
TRK VEH MAI.	16	X	X	X

CRITICAL EQUIPMENT	DAMAGE CASE		
	1	2	3
81 MORTAR	X	X	X
T.O.W.		X	X
COMMAND CARRIER	X	X	X
APC	X	X	X
MORTAR CARRIER	X		X

FIGURE 5-34. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF COMBAT DAMAGE, RIFLE COMPANY, INFANTRY BATTALION (MECH).

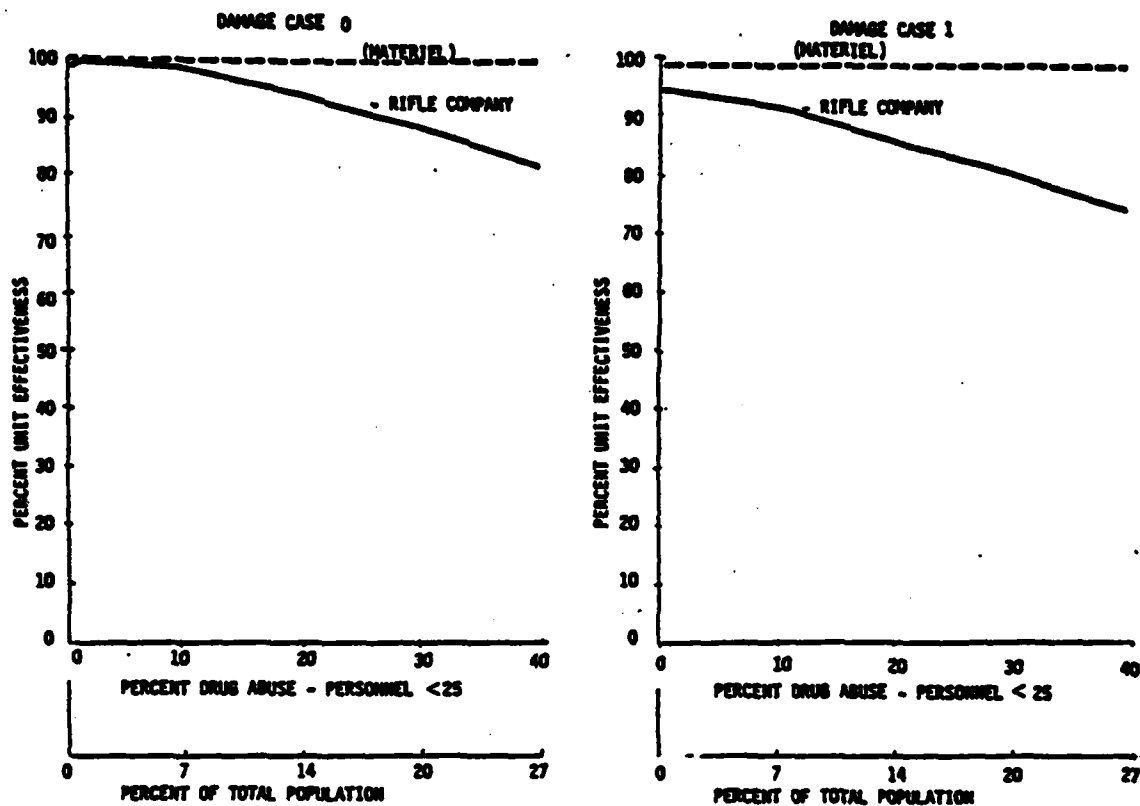


FIGURE 5-35. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE (CASES 0 AND 1) AND VARIOUS LEVELS OF DRUG ABUSE, RIFLE COMPANY, INFANTRY BATTALION (MECH).

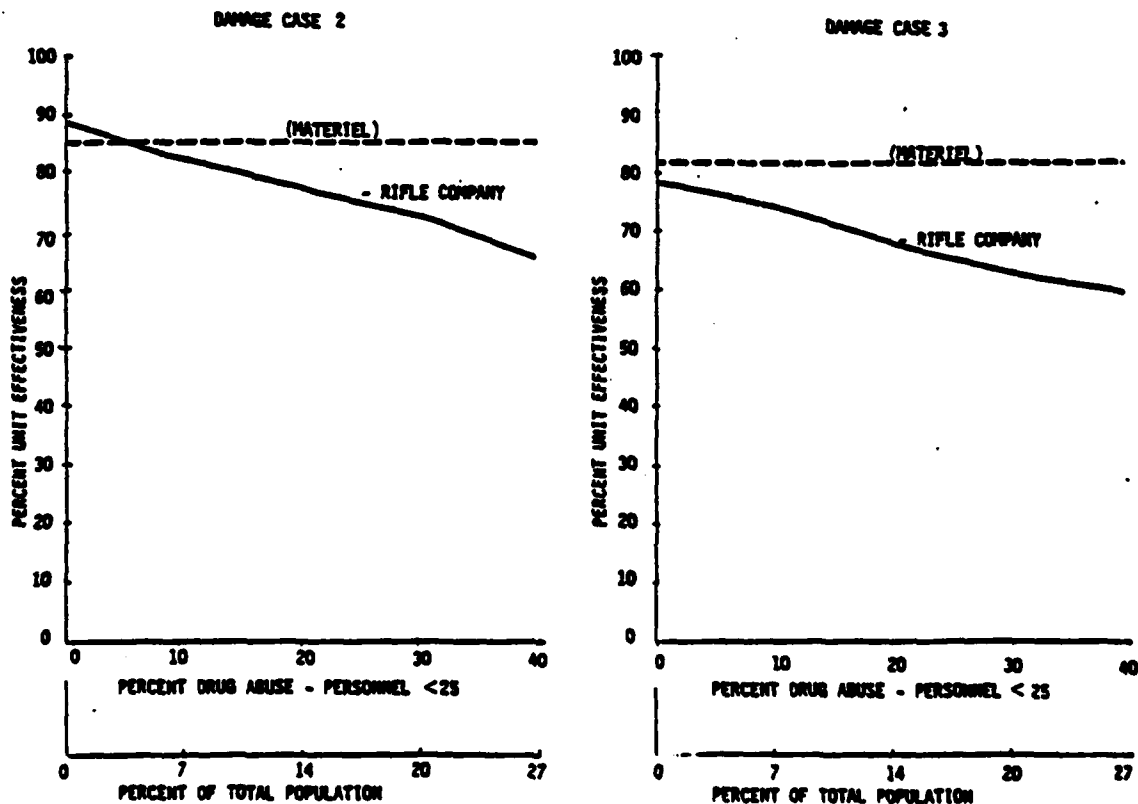


FIGURE 5-36. UNIT EFFECTIVENESS FOLLOWING COMBAT DAMAGE (CASES 2 AND 3) AND VARIOUS LEVELS OF DRUG ABUSE, RIFLE COMPANY, INFANTRY BATTALION (MECH).

twenty-five who are assumed to be drug abusers. The bottom scale relates this percentage to total unit population. For example, ten percent of a rifle company's personnel less than twenty-five years old relates to seven percent of the unit population. The percent of unit effectiveness limited by materiel is shown by a dashed line.

Rifle company effectiveness is limited only slightly at the ten percent drug abuse level and falls off uniformly thereafter. This is particularly evident at Damage Case 0 (no combat damage) and Damage Case 2 (twenty percent personnel casualties).

Critical personnel and required substitutes identified at the four drug-abuse levels are shown for each combat damage case in Figure 5-37 (Case 0), Figure 5-38 (Case 1), Figure 5-39 (Case 2), and Figure 5-40 (Case 3). The addition of drug abuse as a casualty producer resulted in the remaining six personnel functions being identified as critical. They are:

- Rifleman
- Assistant Antitank Gunner
- Antitank Driver
- Company RTO
- Weapons Platoon RTO
- Mortar Ammunition Bearer

Thus, all functions essential to a rifle company are critical to reconstitution of unit effectiveness. No new required substitutes were identified.

The uniform loss of effectiveness with increased drug abuse is a result of a unit having a high degree of substitutability with relatively few surpluses. This situation, coupled with uniform requirements for team construction, resulted in all essential functions being likely to limit unit effectiveness.

DAMAGE CASE 0, RIFLE CO., INFANTRY BATTALION (MECH)

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS.				
		DRUG LEVEL				
TASK	NO	0	1	2	3	4
AT SQD LDR	36		X	X	X	
PD COMP	30		X	X	X	
AST PLT SGT	19		X			
DEN GNR	24	X	X	X	X	
FIRE TH LDR	21	X	X	X	X	
AT GNR	37		X	X	X	
MORT SQD LDR	32		X	X	X	
CD COR	1					
RIFLE SQD LDR	20					
COMM SGT	5					
AT SECT LDR	35					
MORT SECT LDR	27					
MORT GNR	33	X	X	X	X	
RIFLE PLT SGT	18					
GRN	23		X	X	X	
AR MAN	22	X	X	X	X	
MORT SECT LDR	29					
MORT CAR OVR	31	X	X	X	X	
RIFLE PLT LDR	17					
MPH PLT LDR	26					
APC OVR	7		X	X	X	
RIFLEMAN	25				X	X
ASST ATGMR	39					X
AT OVR	38		X	X	X	
CO RTO	8		X	X	X	
MPH PLT RTO	28		X	X	X	
AMMO	34		X	X	X	

REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS				
TASK	NO	0	1	2	3	4
EXEC OFF	2			X	X	X
1 SGT	3			X	X	X
ARMORER	6		X	X	X	X
SUPP SGT	9		X	X	X	X
SR AVO	11		X	X	X	X

CRITICAL EQUIPMENT	
NONE	

FIGURE 5-37. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE CASE 0, RIFLE COMPANY, INFANTRY BATTALION (MECH).

DAMAGE CASE 1, RIFLE COMPANY, INFANTRY BATTALION (MECH)

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS.				
		DRUG LEVEL				
TASK	NO	0	1	2	3	4
AT SQD LDR	36	X	X	X	X	X
PD COMP	30	X	X	X	X	X
AST PLT SGT	19	X	X	X	X	X
DEN GNR	24	X	X	X	X	X
FIRE TH LDR	21	X	X	X	X	X
AT GNR	37	X	X	X	X	X
MORT SQD LDR	32	X	X	X	X	X
CD COR	1	X	X	X	X	X
RIFLE SQD LDR	20	X	X	X	X	X
COMM SGT	5	X	X	X	X	X
AT SECT LDR	35	X	X	X	X	X
MORT SECT LDR	27	X	X	X	X	X
MORT GNR	33	X	X	X	X	X
RIFLE PLT SGT	18	X	X	X	X	X
GRN	23	X	X	X	X	X
AR MAN	22	X	X	X	X	X
MORT SECT LDR	29	X	X	X	X	X
MORT CAR OVR	31	X	X	X	X	X
RIFLE PLT LDR	17	X	X	X	X	X
MPH PLT LDR	26	X	X	X	X	X
APC OVR	7	X	X	X	X	X
RIFLEMAN	25					
ASST ATGMR	39					
AT OVR	38					
CO RTO	8		X	X	X	X
MPH PLT RTO						
AMMO BEARER	34		X			

REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS				
TASK	NO.	0	1	2	3	4
EXEC OFF	2	X	X	X	X	X
1 SGT	3	X	X	X	X	X
ARMORER	6	X	X	X	X	X
SUPPLY CLK	9	X	X	X	X	X
SR REC VEH OP	11	X	X	X	X	X
SR TVM	12	X	X	X	X	X
PLL CLK	13	X	X	X	X	X
C-E MECH	14	X	X	X	X	X
REC VEH OP	15	X	X	X	X	X
TRK VEH MECH	16	X	X	X	X	X

CRITICAL EQUIPMENT	
81 MORTAR COMMAND CARRIER APC MORTAR CARRIER	

FIGURE 5-38. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE CASE 1, RIFLE COMPANY, INFANTRY BATTALION (MECH).

DAMAGE CASE 2 RIFLE COMPANY, INFANTRY BATTALION (MECH)

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS.				
		DRUG LEVEL				
TASK	NO.	0	1	2	3	4
AT SQD LDR	36	X	X	X	X	X
PD COMP	30	X	X	X	X	X
AST PLT SGT	19	X	X	X	X	X
DSN GNR	24	X	X	X	X	X
FIRE TH LDR	21	X	X	X	X	X
AT GNR	37	X	X	X	X	X
MORT SQD LDR	32	X	X	X	X	X
CO CDR	1	X	X	X	X	X
RIFLE SQD LDR	20	X	X	X	X	X
COMP SGT	5	X	X	X	X	X
AT SECT LDR	35	X	X	X	X	X
MORT SEC LDR	27	X	X	X	X	X
MORT GNR	33	X	X	X	X	X
RIFLE PLT SGT	18	X	X	X	X	X
GRN	23	X	X	X	X	X
AR MAN	22	X	X	X	X	X
MORT SECT LDR	29	X	X	X	X	X
MORT CAR DVR	31	X	X	X	X	X
RIFLE PLT LDR	17	X	X	X	X	X
MPN PLT LDR	26	X	X	X	X	X
APC DVR	7	X	X	X	X	X
RIFLEMAN	25	X	X	X	X	X
ASST ATGMR	39	X	X	X	X	X
AT DVR	38	X	X	X	X	X
CO RTO	8	X	X	X	X	X
MPN PLT RTO	28	X	X	X	X	X
APMO BEARER	34	X	X	X	X	X

REQUIRED SUBSTITUTES		DRUG ABUSE LEVELS				
TASK	NO.	0	1	2	3	4
EXEC OFF	2	X	X	X	X	X
1 SGT	3	X	X	X	X	X
ARMORER	6	X	X	X	X	X
SUPPLY CLK	9	X	X	X	X	X
SR REC VEH OP	11	X	X	X	X	X
SR TVM	12	X	X	X	X	X
PLL CLK	13	X	X	X	X	X
C-E MECH	14	X	X	X	X	X
REC VEH OP	15	X	X	X	X	X
TRK VEH MECH	16	X	X	X	X	X

CRITICAL EQUIPMENT	
81 MORTAR T.O.W. COMMAND CARRIER APC	

FIGURE 5-39. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE CASE 2, RIFLE COMPANY, INFANTRY BATTALION (MECH).

DAMAGE CASE 3, RIFLE COMPANY, INFANTRY BATTALION (MECH)

MISSION ESSENTIAL PERSONNEL		CRITICAL PERS.				
		DRUG LEVEL				
TASK	NO.	0	1	2	3	4
AT SQD LDR	36	X	X	X	X	X
PD COMP	30	X	X	X	X	X
AST PLT SGT	19	X	X	X	X	X
DSN GNR	24	X	X	X	X	X
FIRE TH LDR	21	X	X	X	X	X
AT GNR	37	X	X	X	X	X
MORT SQD LDR	32	X	X	X	X	X
GO CDR	1	X	X	X	X	X
RIFLE SQD LDR	20	X	X	X	X	X
COMP SGT	5	X	X	X	X	X
AT SECT LDR	35	X	X	X	X	X
MORT SECT LDR	27	X	X	X	X	X
MORT GNR	33	X	X	X	X	X
RIFLE PLT SGT	18	X	X	X	X	X
GRN	23	X	X	X	X	X
AR MAN	22	X	X	X	X	X
MORT SECT LDR	29	X	X	X	X	X
MORT CAR DVR	31	X	X	X	X	X
RIFLE PLT LDR	17	X	X	X	X	X
MPN PLT LDR	26	X	X	X	X	X
APC DVR	7	X	X	X	X	X
RIFLEMAN	25	X	X	X	X	X
ASST ATGMR	39	X	X	X	X	X
AT DVR	38	X	X	X	X	X
CO RTO	8	X	X	X	X	X
MPN PLT RTO	28	X	X	X	X	X
APMO BEARER	34	X	X	X	X	X

REQUIRED SUBSTITUTES		DRUG ABUSE LEVEL				
TASK	NO.	0	1	2	3	4
EXEC OFF	2	X	X	X	X	X
1 SGT	3	X	X	X	X	X
ARMORER	6	X	X	X	X	X
SUPPLY CLK	9	X	X	X	X	X
SR REC VEH OP	11	X	X	X	X	X
SR TVM	12	X	X	X	X	X
PLL CLK	13	X	X	X	X	X
C-E MECH	14	X	X	X	X	X
REC VEH OP	15	X	X	X	X	X
TRK VEH MECH	16	X	X	X	X	X

CRITICAL EQUIPMENT	
81 MORTAR T.O.W. COMMAND CARRIER APC MORTAR CARRIER	

FIGURE 5-40. MISSION-LIMITING PERSONNEL FUNCTIONS AND EQUIPMENT AT VARIOUS LEVELS OF DRUG ABUSE AND COMBAT DAMAGE CASE 3, RIFLE COMPANY, INFANTRY BATTALION (MECH).

SECTION V

SUMMARY

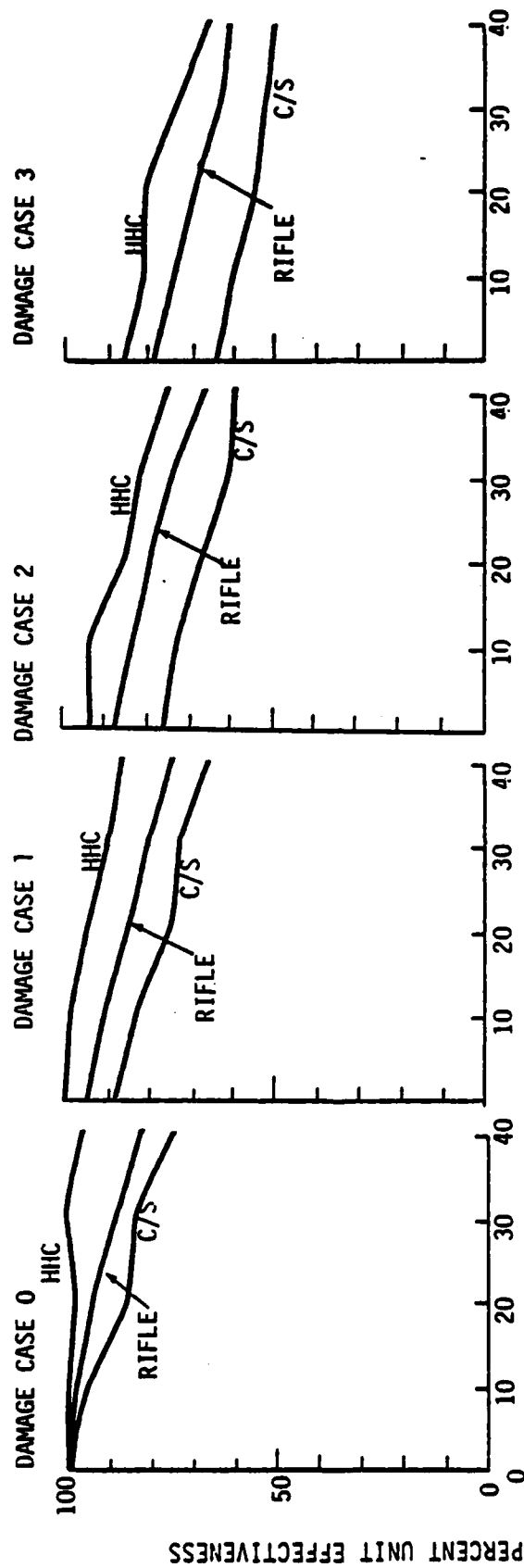
The three company-size units in the mechanized infantry battalion were examined at four combat-damage conditions to determine the risk to unit failure from four levels of drug abuse and to identify personnel critical to unit effectiveness.

The capability of these units to form essential teams of personnel and equipment before and after combat damage is reflected as a function of drug abuse in Figure 5-41. This assumed a drug-caused functional-failure probability equal to the probability of being less than twenty-five years of age at each assumed usage level. Unit effectiveness was limited by personnel in all cases but two. Materiel was limiting for the rifle company at Damage Case 2 (zero drug abuse), and neither materiel nor personnel functions limited effectiveness at Damage Case 1 (zero drug abuse) for HHC. From Figure 5-41, HHC has the largest remaining percent effectiveness at all combat damage and drug-abuse combinations. C/S Company has the least percent effectiveness.

To quantify this risk to drug abuse, a tolerance ratio was defined as the ratio of percent personnel effectiveness lost to percent increase in drug abuse. This is explained more fully in Chapter II, and is used here to compare unit tolerance to drug abuse. A high ratio indicates a low tolerance and hence higher risks to unit effectiveness. Table 5-5 shows the tolerance ratios for the three companies at each damage case.

TABLE 5-5. TOLERANCE RATIOS, INFANTRY BATTALION (MECH)

UNIT	EFFECT OF DRUG ABUSE AT DAMAGE			
	CASE 0	CASE 1	CASE 2	CASE 3
HHC	.06	.35	.46	(.48)
C/S CO	(.63)	.36	(.48)	.35
RIFLE CO	.49	(.49)	.40	.44



PERCENT OF SUSCEPTIBLE PERSONNEL ABUSING DRUGS

FIGURE 5-41. SUMMARY OF UNIT EFFECTIVENESS AT VARIOUS DRUG-ABUSE LEVELS AND DAMAGE CASES.
INFANTRY BATTALION (MECH)

Circled entries indicate the highest ratios (poorest tolerance) at each damage case. Examination of Table 5-5 indicates C/S Company has the poorest tolerance before combat damage. HHC is least affected by drugs. As combat damage increases, the unit with the poorest tolerance shifts from the rifle company (Case 1) through C/S Company (Case 2) to HHC (Case 3). It is of interest that HHC has a decreasing tolerance with added combat damage while the rifle company maintains a relatively constant ratio for all damage levels.

A ranked list of all critical personnel functions is shown at Table 5-6. Table 5-6a lists those personnel found to be critical based on analysis of combat losses. Table 5-6b identifies additional personnel, not identified previously in Table 5-6a, who were found to be critical based on analysis of incidence of drug abuse. Table 5-6b also includes the probability that these additional personnel are less than twenty-five years of age.

TABLE 5-6. CRITICAL PERSONNEL FROM COMBAT DAMAGE AND DRUG ABUSE,
INFANTRY BATTALION (MECH).

a. Personnel Critical From Combat Damage Only

HEADQUARTERS COMPANY	COMBAT SUPPORT COMPANY	RIFLE COMPANY
TASK	TASK	TASK
RATT TN CHIEF	ANTITANK GNR	ANTITANK SQD LDR
RATT OPR	ANTITANK SQD LDR	FIRE DIR COMPUTR
COMM CHIEF	REDEYE GUNNER	ASST PLAT SGT
C-E MECHANIC	REDEYE TEAM CHIEF	DRAGON GNR
WIRE SPECIALIST	ANTITANK SEC LDR	FIRE TEAM LDR
	AST SCT SECT LDR	ANTITANK GNR
	REDEYE SGT	MORTOR SQD LDR
	SCOUT SEC LDR	COMP CDR
	MORTOR GUNNER	RIFLE SQD LDR
	MORTOR PLT SGT	COMM SGT
	FIRE DIR COMPUTR	ANTITANK SEC LDR
	ANTITANK PLAT LDR	MORTOR SECT LDR
	ASST MORTAR GNR	MORTOR GNR
	SCOUT PLT LDR	RIFLE PLT SGT
	MORTOR PLAT LDR	GRENADEIER
	FIRE DIR CHIEF	AUTOMATIC RIFLE
	SCOUT	MORTOR SECT LDR
		MORTOR CAR DR
		RIFLE PLAT LDR
		WPN PLAT LDR
		APC DRIVER

b. Additional Personnel Critical From Drug Abuse

HEADQUARTERS COMPANY	COMBAT SUPPORT COMPANY	RIFLE COMPANY
TASK	TASK	TASK
BN CDR	ANTITANK PLT SGT	RIFLEMAN
BN EXEC/S-3	ANTITANK CARR DR	ASST AT GCR
S-1/2/3/4	SCOUT DR	AT DR
	MORTOR SQD LDR	CD RTO
	REDEYE SECT LDR	WPN PLT RTC
	ASST ANTITANK GNR	MORT AMMO

APPENDIX A

PROBABILITY OF PERSONNEL BEING LESS THAN 25 YEARS OF AGE

This appendix presents the probabilities that personnel assigned to selected tasks in Armored, Field Artillery, and Mechanized Infantry Battalions are less than 25 years of age. The data are presented in Tables A-1 through A-10.

The U.S. Army MILPERCEN provided SAI with distributions by date of birth and duty MOS of all Army personnel assigned to Europe. These data were used to calculate the probabilities that personnel, assigned to selected tasks in each unit analyzed, were less than 25 years of age or 28 years of age.

The resulting probabilities were used in calculating the assumed incidence of drug abuse for each unit. Not surprisingly, none of the higher ranking officers and noncommissioned officers were under 25 years of age and by assumption, therefore, were not considered potential drug users.

Table A-1 is a summary of the age distribution for each of the five units analyzed in this study. The table presents the total personnel assigned to each unit and the percentage of those assigned who could be expected to be under 25 years of age. In each battalion the headquarters unit has the lowest expected percentage less than 25.

Table A-1. Expected Percentage of Personnel
Less Than 25 Years of Age in Each Unit.

	<u>Total Personnel</u>	<u>Percentage <25 Yrs. Old</u>
TANK BN		
HQ & HQ CO.	174	.500
CBT SUPT CO.	91	.664
TANK CO.	88	.580
ARTILLERY BN		
HQ & HQ BTRY.	216	.554
SVC BTRY.	68	.628
FA BTRY.	99	.669
MECH BN		
HQ & HQ CO.	173	.531
CBT SUPT CO.	148	.689
MECH RIFLE CO.	166	.683

TABLE A-2. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, HEADQUARTERS COMPANY, ARMORED BATTALION.

TASK	MOS	NO.	PROBABILITY
CO	12B00	1	0
XO	12B00	2	0
S1	12B41	3	0
S2	35A00	4	0
S4	12B92	5	0
CE ST OF	25A00	6	0
MOT OF	12B77	7	0
CSM	00Z50	8	0
S3 AIR	12B00	9	0
INTEL/OP SGT	19Z50	10	0
ASST OP SFT	19G40	11	.005
PER NCO	75Z30	12	.030
LGL CLK	71D20	13	.424
CLK TYP	71L10	14	.769
OP ASST	19E10	15	.884
PER CAR DR	19F10	16	.921
RAD OP	5B20	17	.400
CAREER CON	00E40	18	0
CHEM NCO	54E30	19	.055
PAC	75B20	20	.477
PAC CLK	75B10	21	.749
INTEL ANAL	96B30	22	.053
COMR	19E30	23	.134
TANK DR	19F10	24	.921
COM CHIEF	31Z40	25	0
RAD TEL OP	5C20	26	.426
SWBD OP/CLK	36K20	27	.388
FLD CE MEC	31V20	28	.458
COMPANY COM	12B00	29	0
COMPANY XO	12B00	30	.443
FST SGT	12Z5M	31	0
SUP SGT	76Y30	32	.055
ARMORER	76Y10	33	.760
MOT SGT	63Z50	34	0
SR TRK VEH MEC	63C20	35	.432
EQ CLK	76D10	36	.787
TRK VEH MEC	63C10	37	.908
AUTO MNT TECH	63IA0	38	0

TABLE A-2. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, HEADQUARTERS COMPANY, ARMORED BATTALION (CONT'D).

TASK	MOS	NO.	PROBABILITY
MOT SGT	63Z50	39	0
REC SGT	63F30	40	.106
TK TUR MT SUP	45K30	41	.069
SR WELDER	44B10	42	.834
PWR GEN MEC	63B20	43	.442
TK TUR MEC	45N10	44	.889
RCVY VEH OP	63F10	45	.897
PLT LDR	67B00	46	.483
SEC COM	12B00	47	.443
TRUCK MSTR	64C40	48	.009
HV VEH DR	64C20	49	.285
AMMO ST	19E10	50	.884
MESS STEW	94B40	51	.005
COOK	94B10	52	.730
SUP SGT	76Y40	53	.006
SUP MAN	76Y10	54	.760
MED PLT LDR	67B00	55	.483
PLT SGT	91B40	56	.021
CLNCL SPEC	91C30	57	.060
MED AID	91B10	58	.767
PHY ASST	911A0	59	0
CLNCL SPEC	91C10	60	.667
MED AID	91B10	61	.767

TABLE A-3. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, COMBAT SUPPORT COMPANY, ARMORED BATTALION.

TASK	MOS	NO.	PROBABILITY
CO	12B00	1	0
XO	12B00	2	.443
FST SGT	12Z5M	3	0
COM CHIEF	31Z40	4	0
SUP SGT	76Y30	5	.055
ARMORER	76Y10	6	.760
P.C. DRIVER	19D10	7	.866
L.V. DRIVER	19D10	8	.866
MOTOR SGT	63C30	9	.036
SR TR.V. MEC	63C20	10	.432
TR V MEC	63C10	11	.908
C-E MEC	31V20	12	.458
PLL CLERK	76D10	13	.787
REC VEH OP	63F20/10	14	.671
AVLB COM	19F20	15	.788
AVLB SEC CH	19E30	16	.134
AVLB DRIVER	19F10	17	.921
REDEYE LD	14B00	18	.483
REDEYE SGT	16P30	19	.064
REDEYE TM CH	16P20	20	.509
REDEYE GUN	16P10	21	.882
SCT PLT LD	12C00	22	.569
SCT PLT SGT	19D40	23	.009
SCOUT	19D10	24	.866
SCT DRIVER	19D10	25	.866
SCT SCT LD	19D30	26	.129
SCT SQD LD	19D30	27	.129
SCT CREW LD	19D20	28	.496
SCOUT	19D10	29	.866
SCT DRIVER	19D10	30	.866

TABLE A-3. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, COMBAT SUPPORT COMPANY, ARMORED BATTALION (CONT'D).

TASK	MOS	NO.	PROBABILITY
H. MORTAR PLT LD	12B00	31	.443
RAD TEL OP	11C10	32	.884
FIRE DIR CH	11C30	33	.114
FIRE DIR CMPT	11C20	34	.454
PER CAR DR	11C10	35	.884
MOR SQD LD	11C20	36	.454
MOR GUNNER	11C10	37	.884
MOR CAR DR	11C10	38	.884
AMM BEARER	11C10	39	.884
ASST GUN	11C10	40	.884

TABLE A-4. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, TANK COMPANY, ARMORED BATTALION.

TASK	MOS	NO.	PROBABILITY
CO	12B00	1	0
XO	12B00	2	.443
FST SGT	19Z5M	3	0
SUP SGT	76Y30	4	.055
COM CHIEF	19E30	5	.134
LT VEH DR	19E30	6	.884
ARMORER	76Y10	7	.760
MOT SGT	63C40	8	.012
REC VEH OP	63F20	9	.671
TR VEH MEC	63C20	10	.784
TANK TUR MEC	45N20	11	.239
FLD RAD MEC	31V20	12	.458
PLL CLK/DR	76D20	13	.263
PLT LDR	12B00	14	.443
PLT SGT	19E40	15	.006
TANK COM	19E30	16	.134
TANK GUNR	19E20	17	.541
TANK LDR	19E10	18	.884
TANK DR	19F10	19	.921

TABLE A-5. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, HEADQUARTERS BATTERY, FIELD ARTILLERY BATTALION.

TASK	MOS	NO.	PROBABILITY
BN CMDR	13 E00	1	.000
BN XO	13 E00	2	.000
BN MOTOR O	13 E77	3	.000
SGM/1 SGT	13 Y5M	4	.000
BTRY CMDR	13 X00	5	.000
NESS SGT	94 B40	6	.005
MOTOR SGT	63 C30	7	.036
SUPPLY SGT	76 Y40	8	.055
COOK	94 B1-3	9	.514
SR TRK VEH MECH	63 C20	10	.432
TRK VEH MECH	63 C10	11	.908
SR WHL VEH M	63 B20	12	.346
WHL VEH MECH	63 B10	13	.865
S-1	13 E41	14	.000
PERS SGT	75 Z3-4	15	.020
CLERK	75 B1-2	16	.787
PHYS ASST	011A0	17	.000
SR AIDMAN	91 B30	18	.046
MED AIDMAN	91 B20	19	.263
BTRY AIDMAN	91 B10	20	.759
LET VEH DR	13 B10	21	.858
REDEYE LT	14 B00	22	.348
REDEYE SGT	16 P30	23	.064
REDEYE CH	16 P20	24	.509
REDEYE GUN	16 P10	25	.882
S3	13 E00	26	.000
S2	13 E35	27	.000
FIR DIR OFF	13 E00	28	.000
OPNS SGT	13 Y50	29	.000
CHIEF COMP	13 E3-4	30	.052
FIR DIR COMP	13 E20	31	.462
CHART CPR	13 E10	32	.801
INTEL OFF	25 A00	33	.123
INTEL SGT	13 W50	34	.000
INTEL SPC	96 B20	35	.436

TABLE A-5. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, HEADQUARTERS BATTERY, FIELD ARTILLERY BATTALION (CONT'D).

TASK	MOS	NO.	PROBABILITY
RECON OFF	13 D35	36	.542
CH SURVEY	82 C3-4	37	.049
SURV CP	82 C20	38	.458
SURV SPC	82 C10	39	.861
WIRE SPC	36 K10	40	.861
CHPIER DR	13 E10	41	.801
CLERK	71 L10	42	.769
CHEM SGT	54 E30	43	.055
LT VEH DR	13 E10	44	.801
C-E OFF	25 A00	45	.000
PLT LDR	25 A00	46	.518
SR COMM CH	31 V50	47	.000
COMM CH	31 V30	48	.066
COMM SPC	31 V10	49	.860
WIRE CH	36 K20	50	.388
WIRE SPC	36 K10	51	.861
RTT CH	05 C30	52	.019
RTT SPC	05 C20	53	.426
RTT OPR	05 C10	54	.840
FSO, BDE	13 E00	55	.000
FSO, BN	13 E00	56	.000
FO, CO	13 E00	57	.542
FS SGT	13 F3-4	58	.044
FO SGT	13 F20	59	.370
FO SPC	13 F10	60	.822

TABLE A-6. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, FIRING BATTERY, FIELD ARTILLERY BATTALION.

TASK	MOS	NO.	PROBABILITY
BTRY CMDR	13A00	1	.000
1ST SGT	13Y5M	2	.000
MESS SGT	94B30	3	.043
MOTOR SGT	63C30	4	.036
SUPPLY SGT	76Y30	5	.055
COOK	94B1-2	6	.590
ARMORER	76Y10	7	.760
MAINT CLK	76D10	8	.787
WHL VEH MECH	63B10	9	.865
TRK VEH MECH	63C10	10	.908
VEH DRIVER	13B10	11	.858
COMM CH	31V30	12	.066
TAC WIRE SPC	36K10	13	.861
XO	13E00	14	.542
FIRE DR O	13E00	15	.542
CH FB/GUN SGT	13B40	16	.004
FIRE DIR COMP	13E2-3	17	.340
CHART CPR	13E10	18	.801
CARRIER DR	13E10	19	.801
DPNS MECH	13B10	20	.858
GUN SEC CH	13B30	21	.048
GUNNER	13B20	22	.332
ASST GUN/CAN	13B10	23	.858
CARRIER DR	13B10	24	.858
AMMO SEC CH	13B20	25	.332
HVY VEH DR	64C1-2	26	.802
AMMO HNDLR	13B10	27	.858

TABLE A-7. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, SERVICE BATTERY, FIELD ARTILLERY BATTALION.

TASK	MOS	NO.	PROBABILITY
BTRY CMDR	13E92	1	.000
1ST SGT	13Y5M	2	.000
MESS SGT	94B30	3	.043
MOTOR SGT	63B30	4	.049
SUPPLY SGT	76Y30	5	.055
COOK	94B1-2	6	.590
ARMORER	76Y10	7	.760
MAINT CLK	76D10	8	.787
WHL VEH MECH	63B10	9	.865
TAC WIRE SPC	36K10	10	.861
LT VEH DR	13B10	11	.858
BN SUPPLY SGT	76Y40	12	.006
GEN SUPPLYMAN	76Y20	13	.337
GEN SUPPLYMAN	76Y20	14	.760
HVY VEH DR	64C10	15	.845
LT VEH DR	64C10	16	.845
AUTO TECH	63CA0	17	.000
BN MOTOR SGT	63Z50	18	.000
SR RECLV OPR	63F20	19	.445
RECV VEH OPR	63F10	20	.897
SR TRK VEH M	63C20	21	.432
TRK VEH MECH	63C10	22	.908
SR WHL VEH M	63B20	23	.346
WHL VEH MECH	63B10	24	.865
WELDER	44B10	25	.834
WRECKER OPR	63C10	26	.908
PLL CLERK	76D10	27	.787
AMMO OFFICER	13E00	28	.542
AMMO SGT	13B40	29	.004
AMMO AGENT	13B10	30	.858
AMMO CLERK	71L10	31	.769
AMMO SEC CH	13B30	32	.048
AMMO HNDLR	13B10	33	.858
SR HVY VEH DR	64C30	34	.041
HVY VEH DR	64C1-2	35	.721

TABLE A-8. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, HEADQUARTERS COMPANY, MECHANIZED INFANTRY.

TASK	MOS	NO.	PROBABILITY
BN CD	11COD	1	.000
XO/S3	11COO	2	.000
CE OFF	25A00	3	.000
MTR OFF	11C77	4	.000
S1/2/3/4	11COO	5	.000
CSM	00Z5	6	.000
CO CDR	11X0	7	.000
XO/PLTLD	11X0	8	.524
1 SGT	11B5	9	.005
SUP SGT	76Y3	10	.055
ARM/SUP	76Y1	11	.760
DVR	11B1	12	.871
ST/SGT	11B5	13	.005
PSNCO	75Z3	14	.030
LG/CLK	7102	15	.424
CLK	71L1	16	.769
DVR	11B1	17	.871
RTO	05B1	18	.870
DVR	11B1	19	.871
REVP	79D3	20	.000
CHEM NCO	54E3	21	.055
INT OFF	35A0	22	.329
SR ANAL	69B3	23	.053
PAC CLK	75B2	24	.477
COM CH	31V4	25	.011
RAH CH	05C2	26	.426
CE MECH	31V1	27	.860
RAH OP	05C1	28	.840
WIRE SP	36K1	29	.860
TM CH	36K2	30	.388
AM CH	11B3	31	.063
SQD LDN	64C3	32	.041
VEL DVR	64C1	33	.845
HVCH DVR	64C2	34	.284

TABLE A-8. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, HEADQUARTERS COMPANY, MECHANIZED INFANTRY (CONT'D).

TASK	MOS	NO.	PROBABILITY
AMM	11B1	35	.871
SUP SGT	76Y4	36	.006
SUP MAN	76Y1	37	.760
FD SVC	94B4	38	.004
COOK	94B3	39	.043
COOK	94B2	40	.265
A/COOK	94B1	41	.730
MAINT	630A0	42	.000
MTR SGT	63C4	43	.012
REC SGT	63F3	44	.106
VEH OP	63F2	45	.445
SRT VM	63C2	46	.432
PLL CLK	76D1	47	.787
RCV OP	63F1	48	.896
TVM	63C1	49	.908
WELDER	44B1	50	.834
MED LD	67B00	51	.483
MED SGT	91C4/3	52	.033
CLIN SPR	91C/1	53	.667
MEDVE	91B2	54	.263
PA W.O	011A	55	.000
MEDIC	91B1	56	.767

TABLE A-9. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, SUPPORT COMPANY, MECHANIZED.

TASK	MOS	NO.	PROBABILITY
CDR	11C00	1	.000
XO OFF	11C00	2	.581
1 SGT	11B5	3	.005
SUP SGT	76Y3	4	.055
COM CL	31V3	5	.066
ARN	76Y1	6	.760
PC DVR	11B1	7	.871
WINEM	36K1	8	.861
RTO	11B1	9	.871
MR SGT	63C4	10	.012
SR RCVOP	63F2	11	.445
SR TVM	63C2	12	.432
PLL	76D1	13	.787
COM MECH	31V1	14	.860
RCVOP	63F1	15	.897
TVM	63C1	16	.908
SCT LDR	11C00	17	.581
PSGT	19D4	18	.009
PC DVR	19D1	19	.866
SCOUT	19D1	20	.866
SCT LDR	19D3	21	.129
A/SCT LDR	19D2	22	.496
MORT LL	11A00	23	.313
MORT SGT	11C4	24	.033
FD CH	11C3	25	.114
FD COP	11C2	26	.454
PC DVR	11C1	27	.884
RTO	11C1	28	.884
MS LDR	11C2	29	.454
MORT GN	11C1	30	.884
A/GNR	11C1	31	.884
A DEA	11C1	32	.884
ATCL	11C00	33	.581
AT SGT	11H4	34	.000

TABLE A-9. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, SUPPORT COMPANY, MECHANIZED (CONT'D).

TASK	MOS	NO.	PROBABILITY
RTO	11H1	35	.866
AT SCT LDR	11H3	36	.121
AT SQD/LD	11H2	37	.471
GNR	11H1	38	.866
PC DVR	11H1	39	.866
A GNV	11H1	40	.866
RED EY	14B00	41	.483
RE SGT	16P3	42	.064
RE CH	16P2	43	.509
RE GVR	16P1	44	.882

TABLE A-10. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, RIFLE COMPANY, MECHANIZED INFANTRY BATTALION.

TASK	MOS	NO.	PROBABILITY
CDR	11C0	1	.000
XO	11C0	2	.581
1 SGT	11B5	3	.005
SUP SGT	76Y3	4	.055
COM SGT	31V3	5	.066
ARMOR	76Y1	6	.760
PC DVR	11B1	7	.871
RTO	11B1	8	.871
GEN SUP	76Y1	9	.760
MTR SGT	63C3	10	.036
SR RVO	63F20	11	.445
SR TVM	63C20	12	.432
PLL CLK	76D10	13	.787
CE MECH	31V10	14	.860
RCVO	63F10	15	.897
TVM	63C10	16	.908
PLDR	11C00	17	.581
P SGT	11B40	18	.023
A P SGT	11B30	19	.063
S LDR	11B30	20	.063
TLDR	11B20	21	.440
AR	11B10	22	.871
GREN	11B10	23	.871
DGN	11B10	24	.871
RMAN	11B10	25	.871
WLDR	11C00	26	.581
WSGT	11C40	27	.033
RTO	11C10	28	.884
MLDR	11C30	29	.114
FD COM	11C20	30	.454
PC DVR	11C10	31	.884
MSLDR	11C20	32	.454
MGNR	11C10	33	.884

TABLE A-10. PROBABILITY BY MOS THAT PERSONNEL ARE LESS THAN 25 YEARS OF AGE, RIFLE COMPANY, MECHANIZED INFANTRY BATTALION (CONT'D).

TASK	MOS	NO.	PROBABILITY
AMMO DR	11C10	34	.884
AT SECT LDR	11H3	35	.121
AT SLDR	11H2	36	.471
AT GNR	11H1	37	.866
A AT GNR	11H1	38	.866
PC DVR	11H1	39	.866

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AN ASSESSMENT OF THE HYPOTHETICAL IMPACT
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VOLUME I - FINAL REPORT

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